

15 May 03

TB 43-0239


# **Maintenance in the Desert**

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*This TB supersedes TB 43-0239 dated 15 Oct 1990*

# Keep Your Equipment “Cool” in the Heat

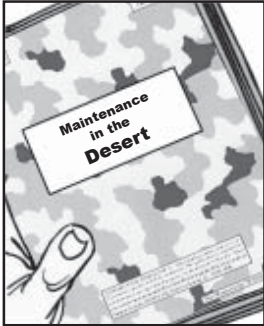
MISSIONS PERFORMED IN THE HEAT OR IN THE DESERT WILL BE SUCCESSFUL ONLY IF YOU'VE PLANNED AHEAD BY DOING PM.



BUT STANDARD PM IS NOT ENOUGH WHEN YOU'RE WORKING IN HEAT OR BLOWING SAND AND DUST. THESE EXTREME CONDITIONS WILL MEAN CHANGES IN THE WAY YOU DO PREVENTIVE MAINTENANCE AND IN THE PREVENTIVE MAINTENANCE YOU DO.



THIS TB IS DEVOTED TO PM TIPS THAT WILL STAND YOU IN GOOD STEAD IN THE HEAT AND SAND.



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THUMB THROUGH THE BOOK AND FIND INFORMATION ON **COOLING SYSTEMS, AIR INDUCTION SYSTEMS, FUEL SYSTEMS, BATTERIES, TIRES, FUEL SYSTEMS, WEAPONS, COMMUNICATIONS EQUIPMENT, AVIATION AND MUCH MORE.**



IN ALL CONDITIONS—**WEATHER AND TERRAIN**—PM MAKES A DIFFERENCE IN WHETHER A MISSION SUCCEEDS OR FAILS.



BUT IN EXTREME CONDITIONS SUCH AS HIGH HEAT AND DESERT, PM MAY BE THE **MOST IMPORTANT ELEMENT** OF YOUR BATTLE PLAN.



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# Wheeled Vehicles

M1112 Water Trailer...

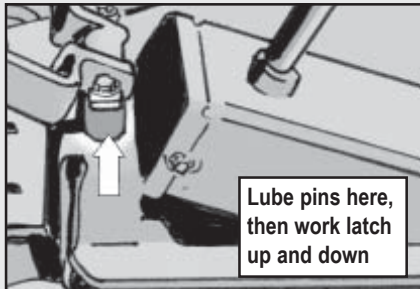
## GOT A LEG TO STAND ON?



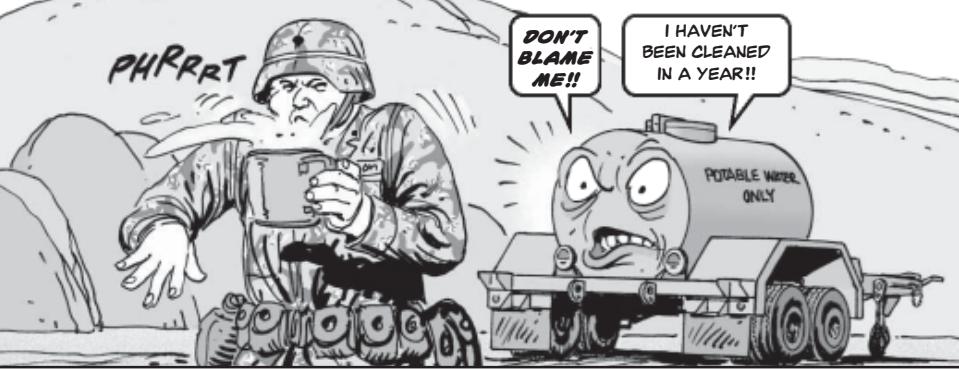
You can't unhook your M1112 water trailer from the towing truck if the landing leg won't deploy. And the landing leg won't deploy if you don't take good care of the release latch.

The release latch has no lube points, so it's usually ignored when it's time to lube the trailer. But then the latch rusts in place and won't move.

Give your trailer a leg to stand on by putting a few drops of OE/HDO oil on the latch's release pins. Then, raise and lower the latch a few times to work in the oil.



# Be Keen On Clean for Water Tank



IF YOU'RE TRYING TO REMEMBER THE LAST TIME YOU CLEANED THE TANK ON YOUR WATER TRAILER, IT'S PROBABLY TOO LATE...

...ESPECIALLY IF YOU'VE GOT A FIELD EXERCISE TOMORROW!

Cleaning the tank regularly will improve the taste of the water and keep the tank safe to use when it's needed. So follow these tips to keep your drinking water from tasting slimy, rusty, or metallic.

- Make sure you drain the tank completely between uses. Water left in the tank causes rust, mineral deposits and algae buildup.

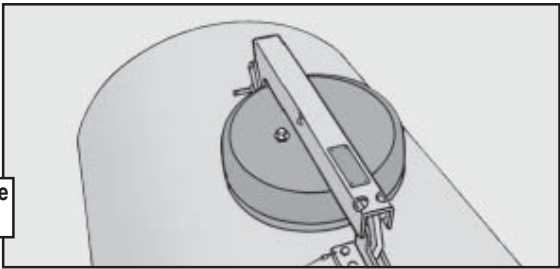
Put the trailer on an incline with the rear slightly lower than the front so that all water will drain through the drain plug. Then open the faucets to let out any water still in the pipes.

Drain tank on slight incline



- Close the manhole cover tightly when the water trailer is in storage. That keeps out dirt, sand and rainwater.

Keep manhole cover closed



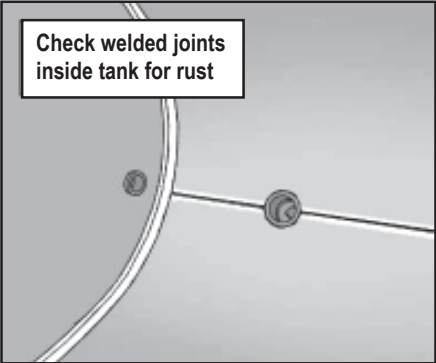
- Every three months, pour 8 gallons of vinegar, NSN 8950-01-079-3978, into the tank and leave it for 5-6 hours. Then empty the tank and flush it out with clean water. The vinegar kills algae and prevents deposit buildup.

Since algae is a bigger problem when it's hot, clean the tank more often during the summer.

- Before filling a tank with drinking water, eyeball the weld joints inside the tank for signs of rust. Scrub away any rust with a solution of water and scouring powder, NSN 7930-01-294-1116. Always use a nonmetallic, nylon brush such as NSN 7920-00-061-0038, to avoid scratching the tank's inner surface.

Flush the tank thoroughly with clean water. Then scrub it again if you see any more rust.

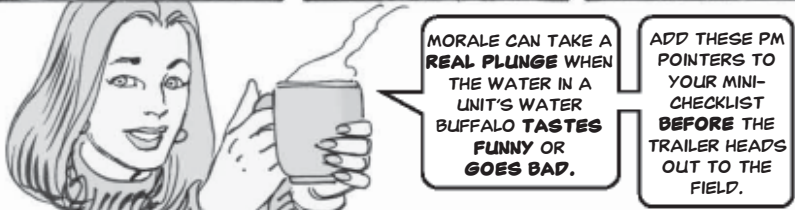
Check welded joints inside tank for rust



## M1112 Water Trailer Bearings

The wheel bearing listed in TM 9-2330-397-14&P is for the bearing only. To get the race and outer bearing assembly, order NSN 3130-00-100-5997 (Fig 13, Item 25). The inner bearing and race assembly come with NSN 3130-00-100-5303 (Fig 13, Item 22).

KEEP WATER

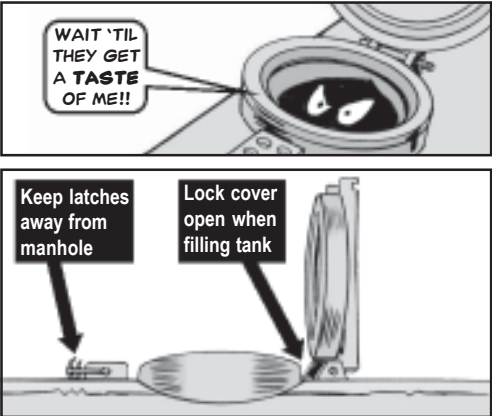


Manhole Seal Reminder

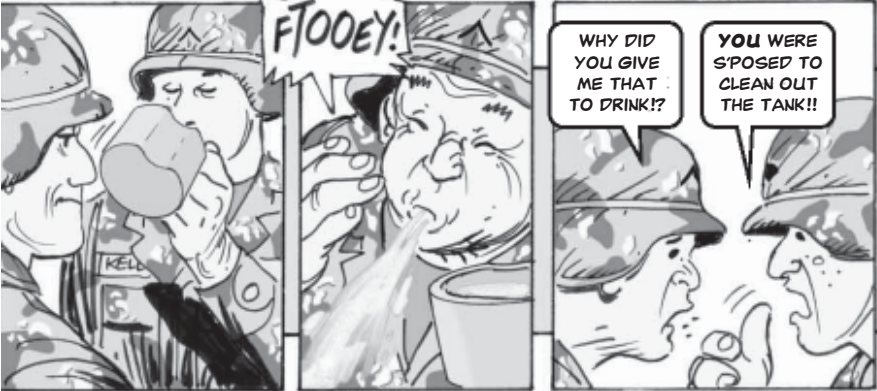
It takes just a moment of carelessness to poke a hole in the manhole cover seal on the water trailer.

If you don't get the cover latches out of the way, any time the cover closes the seal takes a poke. Any hole in the seal can lead to contamination of your unit's drinking water.

In addition to making sure the latches are out of the way, lock the cover open while filling the tank. That way, the cover can't close unless you want it to.

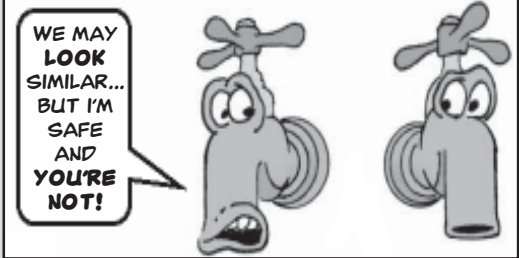


FLOWING



Water Faucet Update

Use NSN 4510-01-433-0396 to get a faucet made to dispense potable water from the water trailer. The stock number shown for Item 1, Fig 28, in TM 9-2330-267-14&P cannot be used for potable water.



Stop the Drip

A leak around the plastic plug, NSN 4730-01-086-1620, under your water trailer probably means it was overtightened when last installed.

Overtightening strips threads, causing leaks. It also makes the plug hard to remove.

So head off leaks and removal problems by wrapping every new plug's threads with antiseize tape, NSN 8030-00-889-3535, and by lightly snugging it in place. That way, the plug can be used several times.



## Better Seal Deal

IF YOU'VE **ALREADY** POKED A HOLE IN THE SEAL, YOU CAN REPLACE IT WITH AN IMPROVED SEAL THAT WILL MAKE LEAKS A THING OF THE PAST.

BUT THAT SEAL, NSN 5330-01-317-9640, IS ONLY AS GOOD AS ITS INSTALLATION.

HERE'S WHAT TO DO...

1. Remove the manhole cover.
2. Scrape off the old seal and toss it.
3. Sand the outer 1½ inches of the underside of the cover with emery paper.
4. Use denatured alcohol to wash the sanded area. Be careful not to touch the sanded and washed area with your bare hand. Oil or dirt from your hand can keep the sealant from working properly.
5. Let the cleaned area dry.
6. Spread a 1-in wide band of silicone adhesive, NSN 8040-00-118-2695, around the outside cover.
7. Slip the seal onto the cover.
8. Put a little more sealant around the inside of the seal where it meets the cover.
9. Now lay the cover with the seal side down on a smooth, flat surface, such as a work bench. Let the sealant cure for 24 hours.
10. Rinse the cover with clean water.
11. Install the manhole cover on the tank.

Spread silicone adhesive here

THE NEW SEAL SEALS OUT LEAKS...IF YOU INSTALL IT CORRECTLY!

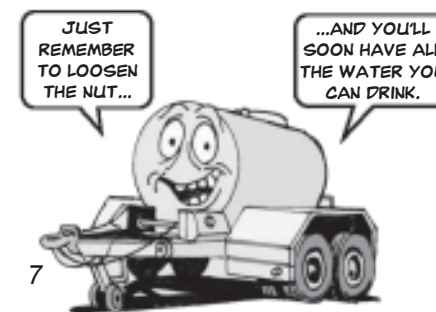
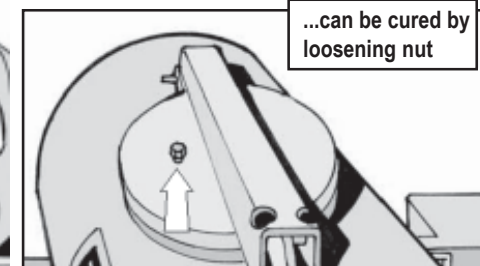
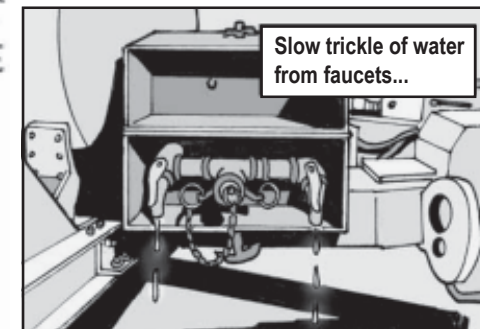
# THE TRICKLE-DOWN EFFECT



There's nothing better than a cool drink of water on a hot day. There's also nothing more frustrating than getting just a trickle of water from the faucet of your M1112 water trailer.

There's plenty of water in the trailer and the faucet is on full blast, so what's the problem?

Could be that you forgot to loosen the small nut on the manhole cover. If the nut's not loosened, air can't get into the tank and a vacuum forms. That slows the water down to a trickle.



Tires...

# KEEP THEM ROLLING WITH PM



Tires catch a lotta grief when you drive in the desert. Heat and terrain team up to deliver a one-two punch that can KO your mission—unless you are prepared by PM.

## Cut the Heat

During normal operations in an average climate, tires get hot as they flex under a load. But they have a chance to cool off when the mission is done. When the air temperature is high, the tires can't cool off, and the excess heat weakens them.

Since you can't do anything about the outside temperature, you can help by not overloading the vehicle. An overloaded vehicle creates extra heat on the tires.

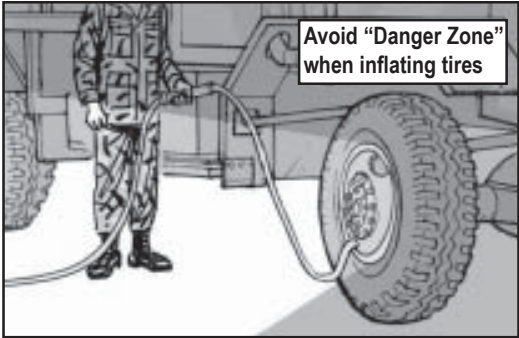
Take that heat off the tires by reducing the load. Plus, a reduced load will reduce the chances that you'll bog down in sand. This goes double for trailers you're pulling. Keep them loaded as lightly as possible.

## In Sand?

Some vehicle operator's manuals list a lower tire pressure for driving in sand. A lower tire pressure gives more flotation and traction in sand. However, be sure to add air back to those tires before you drive on pavement.

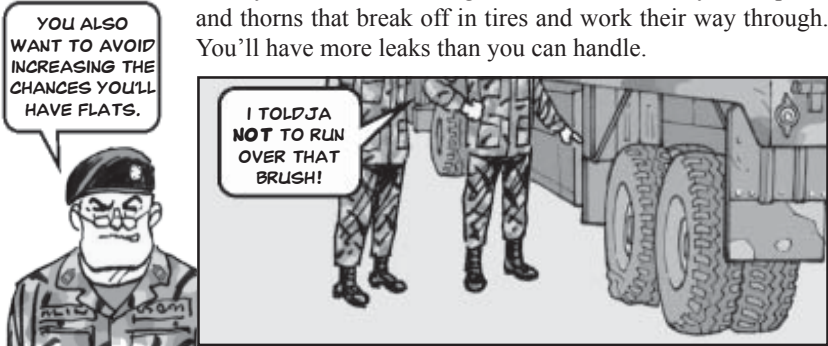
TIRE PRESSURES FOR HEMTTs (for example)				
	Highway	Cross Country-Dry	Cross Country-Wet	Sandy Terrain
Front (all models)				
Standard Tire	60 psi (414 kPa)	35 psi (241 kPa)	20 psi (138 kPa)	30 psi (207 kPa)
Sand tire	60 psi (414 kPa)	NA	NA	25 psi (172 kPa)
Rear				
M977, M978, M983				
Standard Tire	70 psi (483 kPa)	40 psi (276 kPa)	30 psi (207 kPa)	35 psi (241 kPa)
Sand tire	70 psi (483 kPa)		NA	30 psi (207 kPa)

Note that if you must add more than 10-15 psi to the tires you need to use a tire inflator gauge, NSN 4910-00-441-8685. That gives you 10 feet of hose between the gauge and the chuck so you can stand away from the danger zone created by a flying split ring or an exploding tire.



## Avoid Flats

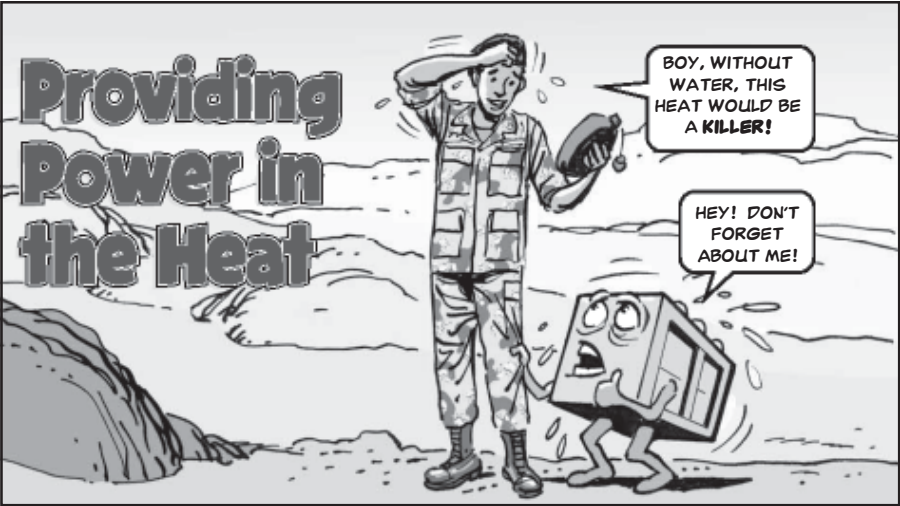
Try not to run over overgrowth or brush that may have spines and thorns that break off in tires and work their way through. You'll have more leaks than you can handle.



Take it easy moving over rocky, rough terrain. The sidewalls of radial tires are thinner than those of bias tires, and rocks cut them to ribbons. Wheeled construction and material handling equipment is especially prone to tire damage because the mission often requires them to work where the going is rough.

Tubeless tires have a special problem—bead breaking. The bead pulls away from the rim, letting air escape. Bead breaking is caused by traveling over rocky terrain. Check the air pressure in tubeless tires often.





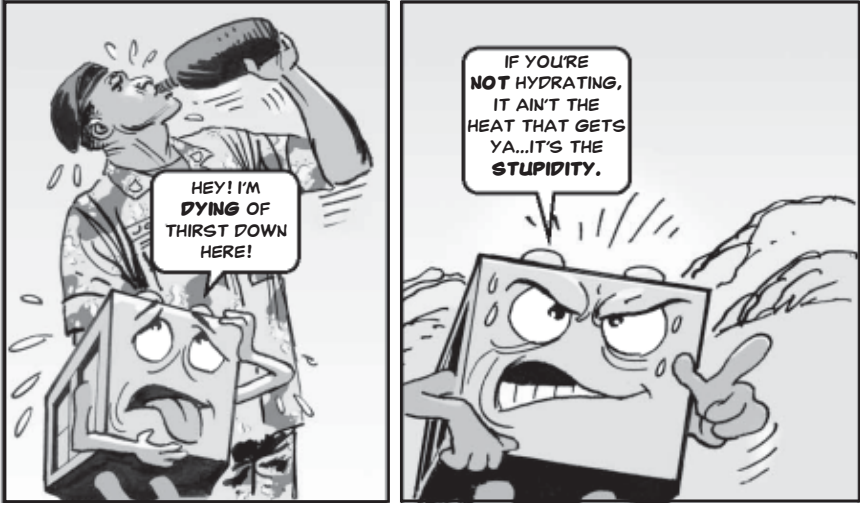
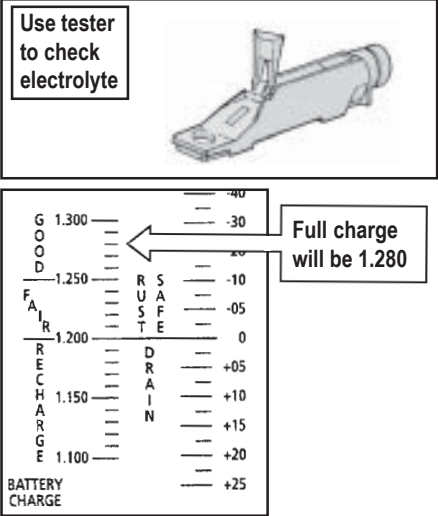
Working in the heat means drinking lots of water so your body stays hydrated. So you drink lots of water.

Working in the heat also affects the water in lead-acid batteries. So you have to keep them hydrated, too.

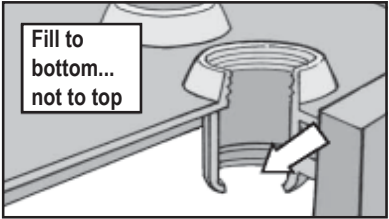
**Where Does It Go?**

Normal charging causes some water in the electrolyte to evaporate. But overcharging drives off much more water. Add in the evaporation caused by high temperatures and your batteries can go dry quickly.

Just adding water won't always be enough to save your batteries. First off, the batteries need to be checked by your mechanic using the optical battery/antifreeze tester, NSN 6630-00-105-1418. A fully-charged battery should give specific gravity readings of 1.280.



Then operators should eyeball the electrolyte levels at least once a day if the temperature stays above 90°F for a week. The level should be at least ½ inch above the top of the battery plates. If the filler hole has a lip or an indicator at the bottom, it should be filled to that.



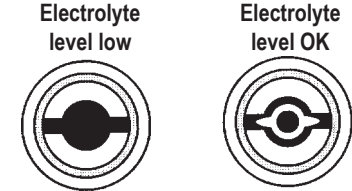
**Adding Just Enough**

More is not better, though. If batteries are filled to the rim, the electrolyte will boil out through the vent caps when the battery charges. Use the battery filler syringe, NSN 6140-00-808-7325, to remove any excess.

Make sure, too, that the vent caps are open so that gases can escape. If the vents are clogged, the battery can explode.

If you find a battery that needs water, let your mechanic know ASAP. The best water is distilled water. NSN 6810-00-682-6867 gets a gallon and NSN 6810-00-356-4936 gets a 5-gal jug.

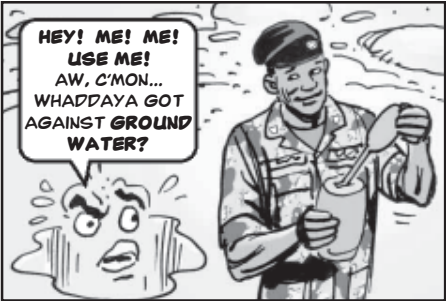
Another good choice is battery water. It has no more than 100 parts per million of impurities, and costs a little less than distilled water. Get a gallon with NSN 6810-00-286-3783 and a 5-gal jug with NSN 6810-00-297-9540.



This bird's eye view shows eye-shape

Ground water has minerals in it that can kill batteries, so don't use it. If there's no other choice, plain drinking water (not mineral water) can be used.

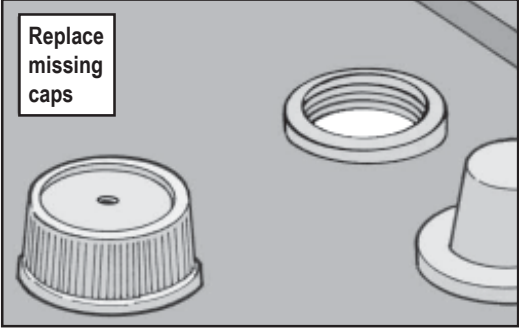
Use a battery syringe or a battery gravity filler, NSN 6140-00-635-3824, for precise filling and help in avoiding overfilling. Both are in the No. 1 Common shop set.



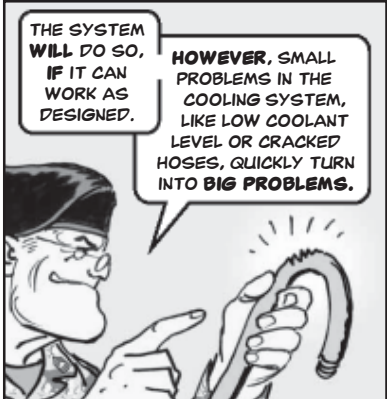
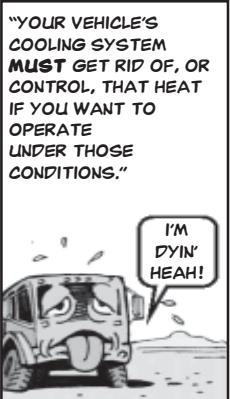
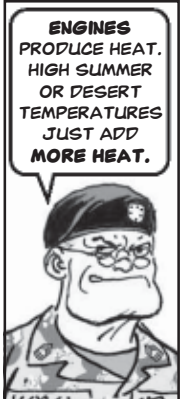
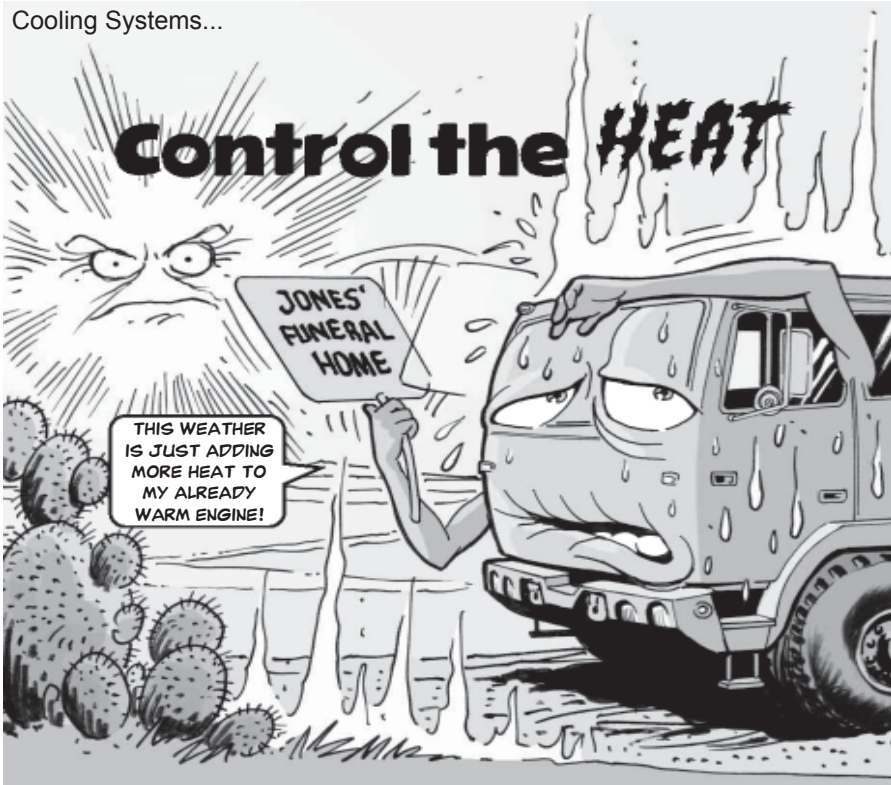
**Tight and Right?**

Make sure the caps are in place on the fill holes. If you need caps, ask your mechanic for them from an unserviceable battery.

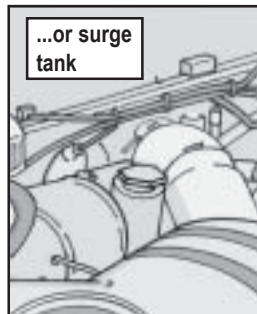
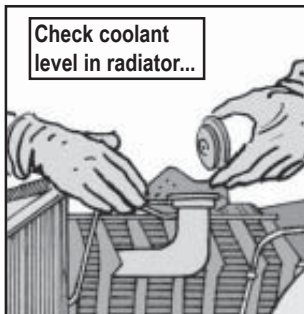
Mixing batteries of different types is OK, as long as you don't use maintenance-free batteries with the older style. It's best to keep 6TLs, 6TLFs and 6TMFs together.



**Cooling Systems...**



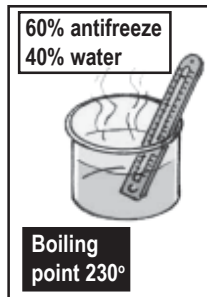
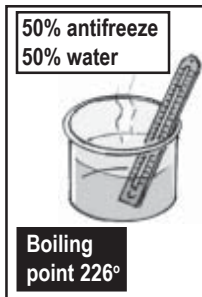
"CHECK THE COOLANT LEVEL OFTEN. BEFORE YOU ROLL, WHEN THE ENGINE IS STILL COOL, MAKE SURE THE COOLANT IS UP TO THE MARK. IF IT'S LOW, ADD COOLANT TO BRING THE LEVEL UP. NEVER OVERFILL, THOUGH. WHEN THE ENGINE HEATS UP, THE EXTRA COOLANT WILL OVERFLOW."



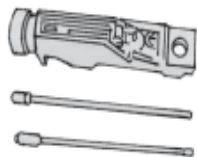
"ADD COOLANT **ONLY** WHEN THE ENGINE IS **COOL**. ADDING COOLANT TO A HOT ENGINE CAN CRACK THE ENGINE BLOCK OR BURST A SEAM IN THE RADIATOR."



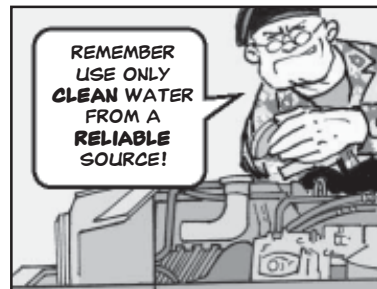
"A 60-40 MIX IS **BEST**, BUT MAINTAIN **AT LEAST** A 50-50 MIX OF ANTIFREEZE AND WATER TO RAISE THE BOILING POINT OF THE COOLANT SO IT WON'T BOIL AWAY LIKE PLAIN WATER."



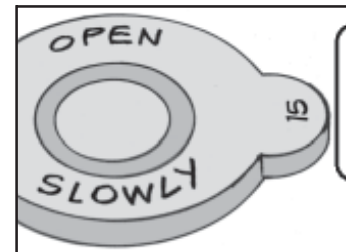
"CHECK THE PROTECTION LEVEL WITH TESTER, NSN 6630-00-105-1418."



"USE DISTILLED WATER, NSN 6810-00-356-4936, IN RADIATORS IF IT'S AVAILABLE. IF NOT, USE POTABLE WATER. GROUND WATER CONTAINS MINERALS THAT WILL CLOG UP THE RADIATOR."



"WHILE YOU'RE ADDING COOLANT, TAKE A CLOSE LOOK AT THE RADIATOR CAP. MAKE SURE IT IS IN TOP-NOTCH CONDITION AND IS THE RIGHT CAP FOR YOUR ENGINE. CHECK THE PRESSURE RATING ON THE CAP WITH THAT LISTED IN YOUR TM."



MAKE SURE YOU'RE USING THE **RIGHT** CAP!



"CHECK FOR WETNESS AROUND THE RADIATOR OR HOSES. WETNESS MEANS A LEAK. FEEL THE HOSES AND REPLACE ALL THAT ARE MUSHY, CRACKED OR LEAKING."

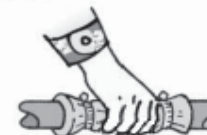


FIND **ANY** OF THESE CONDITIONS AND YOU'LL NEED A **NEW ME!**

**HARD** (cracks are clues)

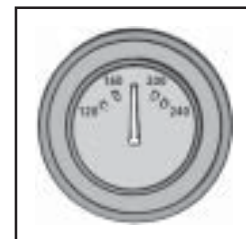


**WET** (or even damp)



**PUFFY**

"DURING OPERATION, KEEP AN EYE ON THE TEMPERATURE GAUGE. IF IT GOES ABOVE THE NORMAL OPERATING RANGE NOTED IN YOUR TM, SHUT DOWN AND FIND OUT WHY."



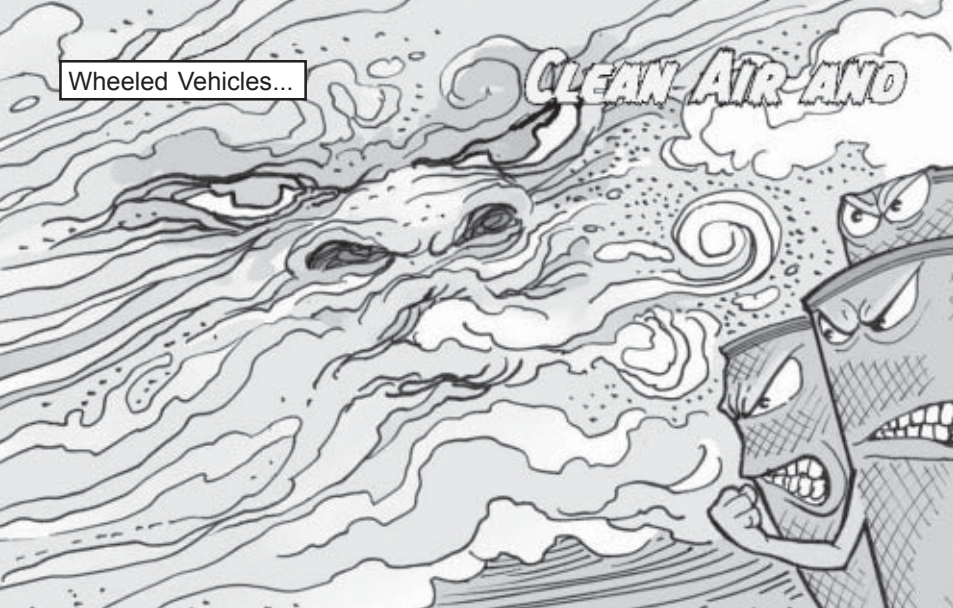
**THIS IS THE PLACE TO BE!**



REMEMBER, TOO, THAT **LOW RPMS** DON'T TURN FANS QUICKLY ENOUGH TO KEEP COOLANT COOL. GEAR DOWN TO CREATE MORE RPMS.



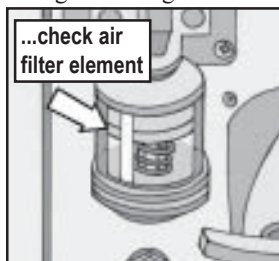
## Wheeled Vehicles...



Make sure your air induction system—hoses, inlets, outlets, filter elements—is in good condition from the get-go.

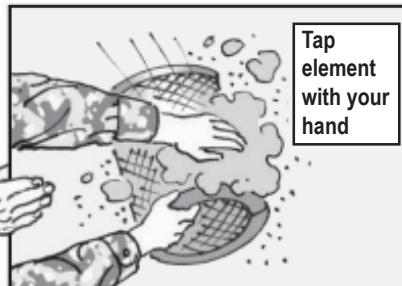
Cracks, tears, holes and loose clamps let sand and dust get into engines.

Clean air filter elements often to keep engine performance high. Keep a close eye on the air restriction indicator if your vehicle has one. Once it turns red, **stop!**

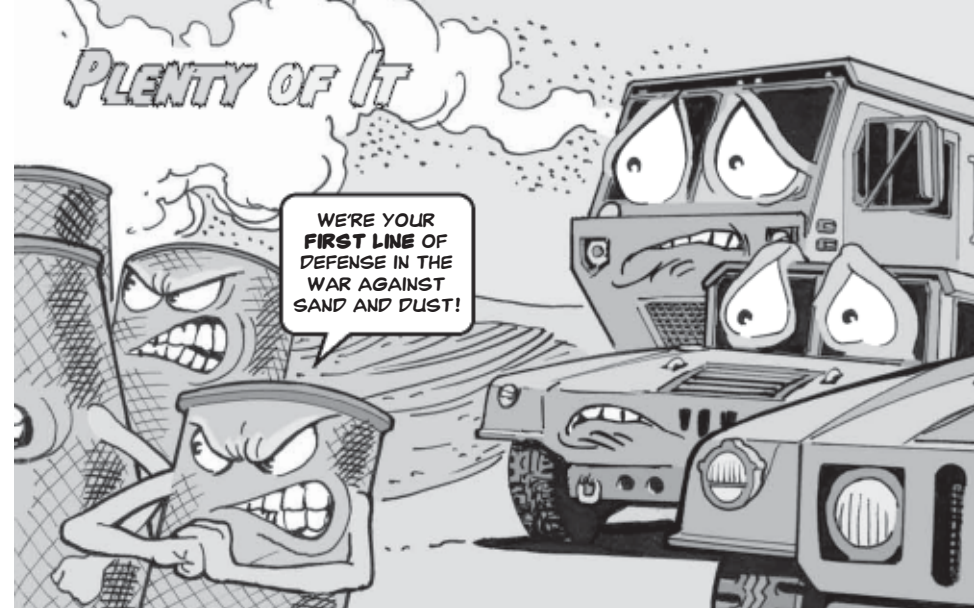


TAKE OUT THE FILTER ELEMENT AND TAP IT TO KNOCK OUT MOST DIRT.

DON'T BANG IT AGAINST ANYTHING HARD BECAUSE YOU'LL BEND ITS SEALING EDGE OR CRUSH IT.



## PLENTY OF IT



If your vehicle does not have an air restriction indicator, your engine will let you know when the element is clogged. You'll notice poor acceleration, lower power output or heavy black smoke from the exhaust.

No restriction indicator?

Look for black smoke or poor engine performance



AN AIR HOSE WILL BLOW AWAY STUBBORN DIRT, BUT USE NO MORE THAN 30 PSI.

IF THAT DOESN'T FREE UP THE ELEMENT, YOUR MECHANIC NEEDS TO WASH OR REPLACE THE ELEMENT.



Use low-pressure air...



...or wash element



For air-cooled surfaces, keep them clean of oil and grease. These surfaces, part of radiators, oil coolers and the like, transfer heat away from the water and oil inside them as air flows past. Oil and grease attract dust and sand. The layer of dust and sand keeps the air from entering and the heat from escaping, which causes engine and transmission damage.

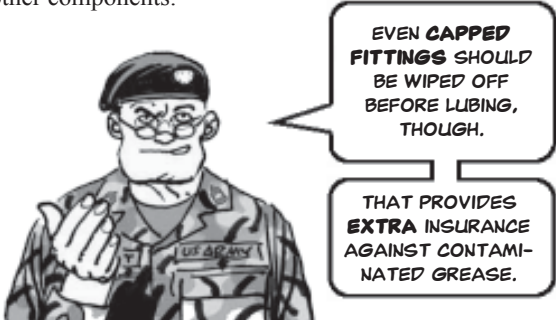


# Combat Vehicles



Getting all the dirt, mud, and sand off your combat vehicle's grease fittings before lubing is important, crewmen. Using a dirty grease fitting forces dirt and sand in along with the grease. Contaminated lube not only won't do its job, but it can damage bearings and other components.

One way to ensure clean fittings is to keep 'em covered. Protective caps, NSN 4730-00-289-8148, do a great job of keeping grease fittings unclogged and dirt-free. So keep plenty on hand and use 'em when doing PMCS.





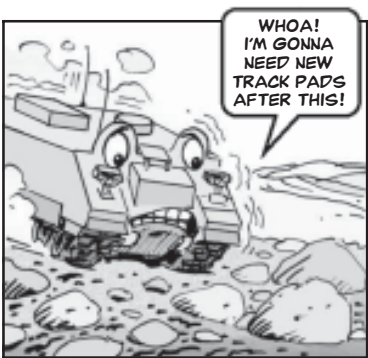
### Heat

Air temperatures of up to 120°F are bad enough, but sand absorbs the heat and can get as hot as 165°F!

Those temperatures are extremely hard on rubber parts. Heat makes track shoes soft and weakens their resistance to sharp rocks and plant spines. High temperatures also increase rubber/metal separation on roadwheels.

Pay special attention to shoes and roadwheels during PMCS. Replace shoes that are severely damaged or worn down to the grouser.

Roadwheels with tread separation of 1 inch or wider (½ inch or wider for M113-series FOV, M992A2 ammo carrier and M109-series SP howitzers) around 75 percent of the wheel should be replaced. Also, replace M113-series FOV roadwheels that have chunking across ½ the width or more of the outer rubber surface.



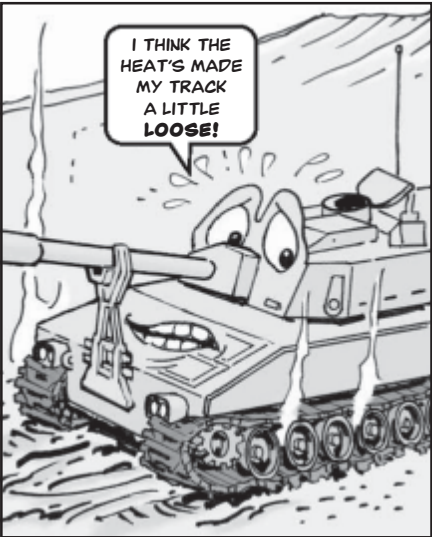
### Track Tension

Since metal expands and contracts with the ups and downs of temperature, proper track tension is essential in the desert.

During the heat of the day, track parts expand and the track runs looser. That results in thrown track.

At night and early in the morning, it's much cooler. Track parts contract and the track runs tighter. The track can bind, causing bent road arms, damaged end connectors and more.

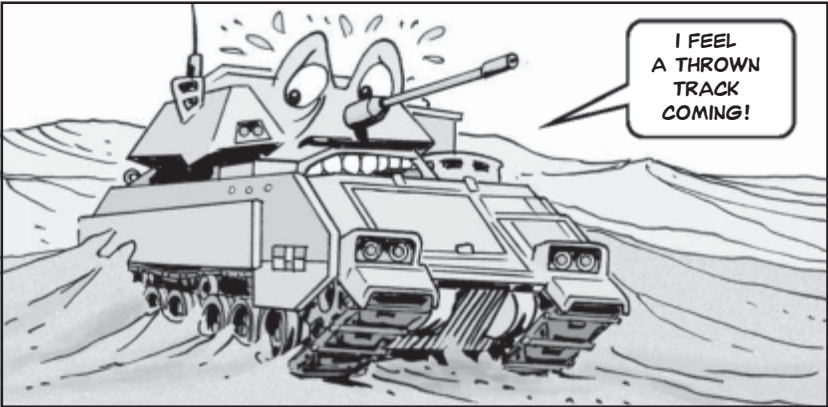
Check track tension often in the desert. Don't try to make it extra loose or tight to compensate for temperature changes. Your best bet is to adjust it according to the TM.



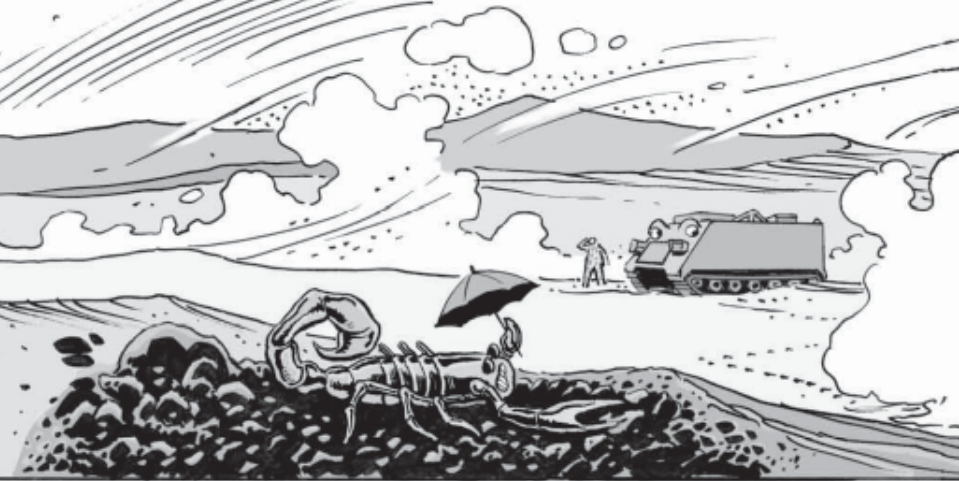
### Driving

Drivers, be wary of a lack of steering response. That indicates sand is building up between the treads and sprockets or idler wheels. If you allow the buildup to continue, the sand will throw the track.

Try “shaking” the vehicle with the steering or backing up to remove sand buildup. Remove accumulated sand by hand at your next stop.



# BATTLING THE ELEMENTS



YOUR -10 TMS PROVIDE A LOT OF GOOD INFO FOR TAKING CARE OF YOUR COMBAT VEHICLE DURING HOT, DUSTY AND SANDY CONDITIONS.

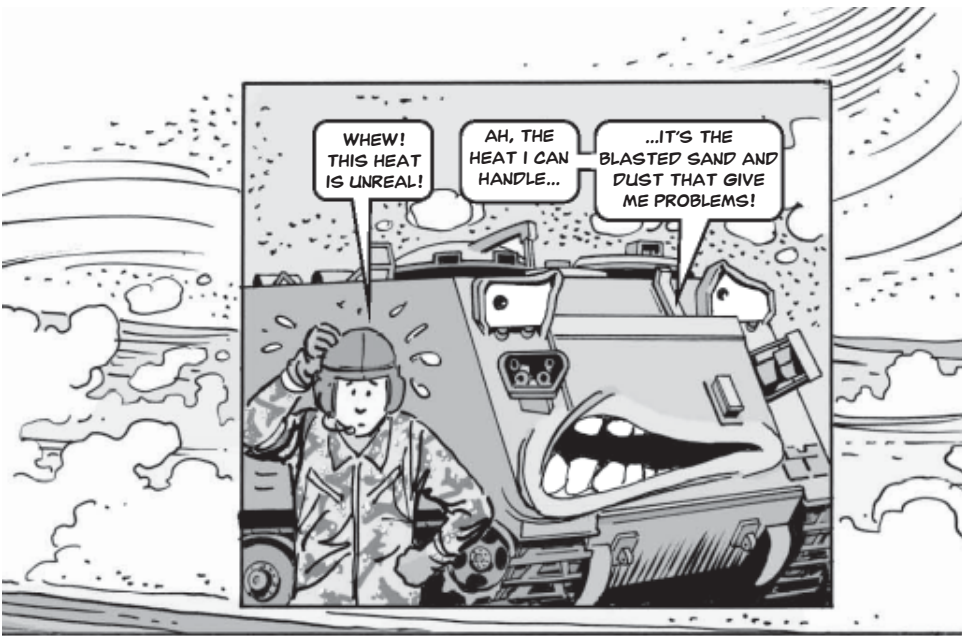
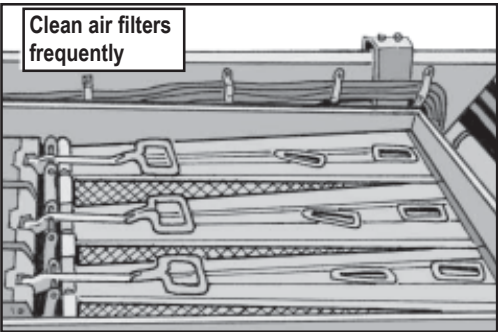
HERE ARE A FEW MORE TIPS FOR KEEPING YOUR VEHICLE UP-TO-SNUFF...

## Clean Air

Make sure your air induction system is in good shape. That includes hoses, inlets, outlets, precleaners, and filter elements. Cracks, tears, holes and loose clamps let sand and dust get into engines.

Pay attention to air restriction indicators. Clean air filter elements as often as necessary to keep engine performance high.

Clean air filters frequently



Park your vehicle with the engine compartment downwind. That allows the bulk of the vehicle to shield the engine from blowing sand or dust.

Keep engine compartment downwind

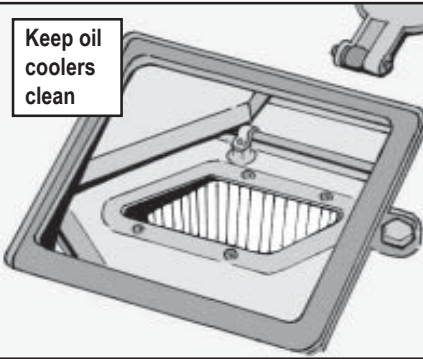


WHEN IT COMES TO THE AIR INDUCTION SYSTEM, IT PAYS TO SWEAT THE SMALL STUFF!



Keep all air-cooled surfaces—oil coolers and radiators—free of oil and grease. These surfaces transfer heat away from the oil and water inside as air flows past them. Oil and grease attract dust and sand like magnets. The heat can't escape and engine and transmission damage are the result.

Keep oil coolers clean



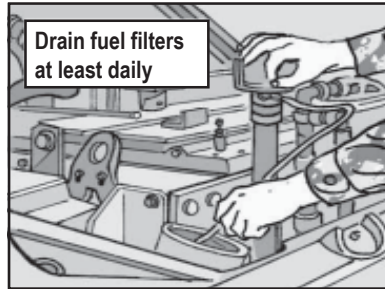
## Clean Fuel

It's critical to keep fuel clean during refueling. Always wipe off the nozzle before refueling. If you suspect there's dirt inside the nozzle, flush it out or take the nozzle off and clean it. Keep the fuel nozzle capped when it's not in use.

Blow away loose dust and sand from the vehicle's fuel filler opening before removing the cap. When the fuel nozzle is in place, use a clean rag to close off any gaps between the nozzle and the fuel filler opening. That keeps blowing sand and dust from getting into the fuel tank. Close the fuel cap tight when you're finished.

No matter how careful you are, some dirt is going to get into the fuel system. That means draining the fuel filters to keep 'em from clogging.

Draining the fuel filters also gets rid of condensation that results from cool nights and hot days. You may need to drain fuel filters more than once a day to keep engine performance high, but they should always be drained at least once a day to keep water from diluting the fuel.



## Clean Water

Local water supplies often contain mineral deposits that will eventually clog up radiator cores.

If local water must be used, filter it through a clean cloth first. Then, clean and purge the radiator at the next opportunity.



## Track Maintenance

Check drive sprocket and roadwheel mounting bolts before, during and after operation. Sand, rocks and gravel tend to break or damage lube fittings and relief valves. Rough terrain causes hardware to work loose.

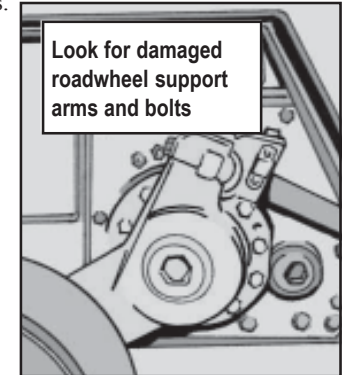
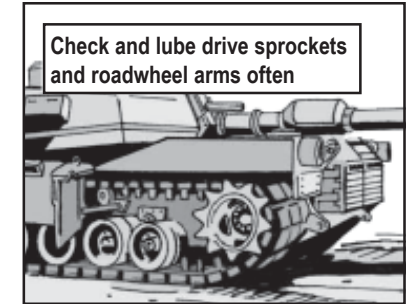
Never neutral steer in soft sand. That lets sand build up in the final drive sprockets and can result in a thrown track. Make fast turns wide. Keep short turns slow.

Pay attention to the tracks during at-halt inspections. Check track tension. Look for cracked end connectors and broken link pins.

On tanks, look for damage to the right front roadwheel support arm and sheared mounting bolts on the No. 1 right or left roadwheel arm housing.

M113-series carriers have more trouble with left rear idler arm bearing burnout. Check often and keep the grease gun handy.

Since you'll be lubing bearings much more often in sandy and dusty conditions, make sure you wipe away any excess lube when you're finished. Grease attracts sand, and combined the two can grind away metal.

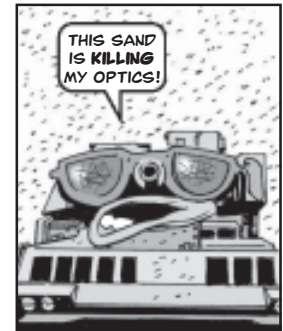


## Optics Care

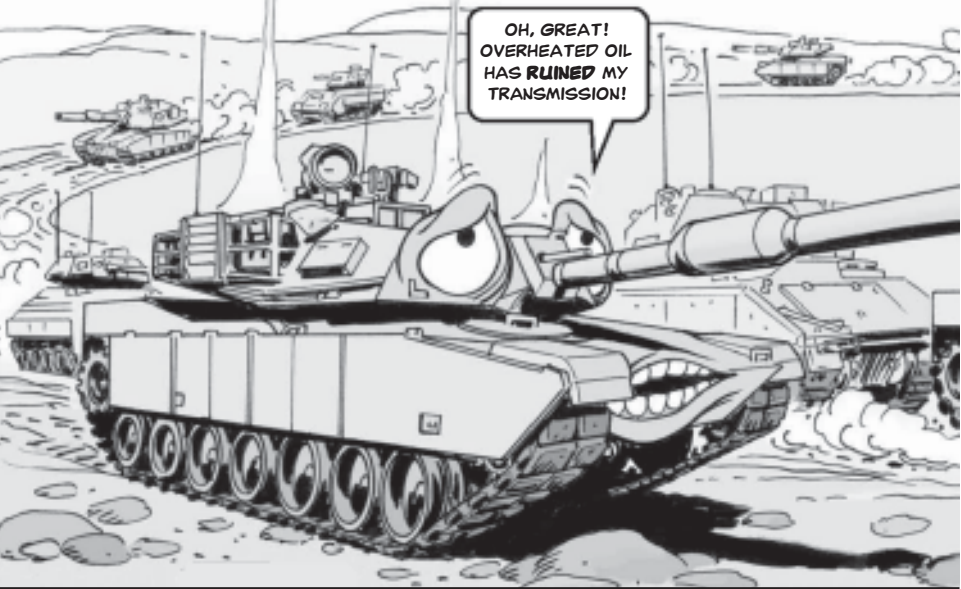
Cover glass surfaces when they're not being used. Scouring and etching by sand and dust will ruin them. That's especially true for sighting and fire control equipment.

The buildup of dust on these surfaces can also degrade low-light vision. So keep surfaces as clean as possible using the specific cleaners called out in your TMs. Optical lens cleaning compound, NSN 6850-00-227-1887, can be used if your TM does not list one.

During dust or sandstorms, you might want to use self-clinging plastic film to cover optics between missions. NSN 8135-00-043-5331 gets a 100-ft roll of 11½-in wide film.

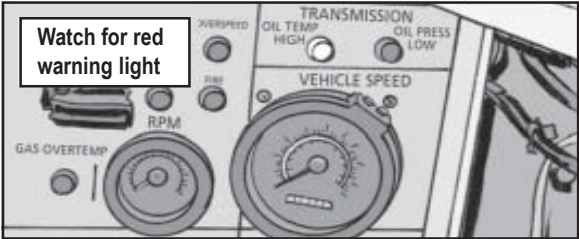


# HELP TRANSMISSION BEAT THE HEAT



A SAND-CLOGGED OIL COOLER MEANS AN OVERHEATED TRANSMISSION FOR YOUR TANK.

You can tell when things get too hot by the warning light on the driver's control panel. Don't overlook it! If the transmission goes down, your mission is over.



Even if the troubleshooting info in your -10-2 TMs doesn't turn up a solution, you shouldn't ignore the light and drive on. There's a problem somewhere, so call in your mechanic.

The first way you can try on the spot. Open the right- and left-hand top grille doors and both rear grille doors. Also, open the access cover to the plenum. Clean out any debris or sand you see in the airway.

Then run the engine at tactical idle while pouring a couple of buckets of water into the access holes. The fans propel the water against the cooler fins hard enough to wash away most of the gunk that's causing the overheating.

Pour water in open access holes

Fan forces water against cooling fins...

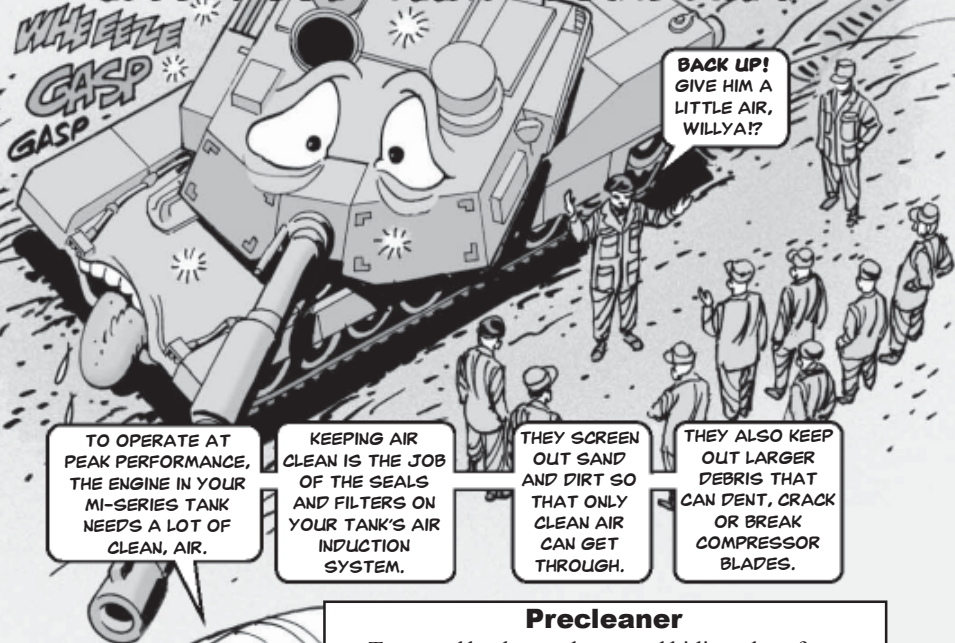
...and cleans gunk off oil coolers

If oil has turned the sand into a sticky mess, you'll need to use the **second way**—a full-blown oil cooler washing. If that is not possible in the field, tow—don't drive—the tank to a location where the oil coolers can be properly cleaned.



M1-Series Tanks...

# GIVE YOUR TANK SOME AIR!



BACK UP!  
GIVE HIM A  
LITTLE AIR,  
WILLYA!?

TO OPERATE AT  
PEAK PERFORMANCE,  
THE ENGINE IN YOUR  
M1-SERIES TANK  
NEEDS A LOT OF  
CLEAN, AIR.

KEEPING AIR  
CLEAN IS THE JOB  
OF THE SEALS  
AND FILTERS ON  
YOUR TANK'S AIR  
INDUCTION  
SYSTEM.

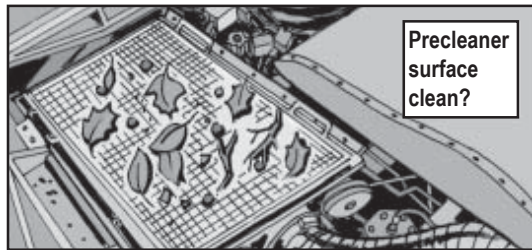
THEY SCREEN  
OUT SAND  
AND DIRT SO  
THAT ONLY  
CLEAN AIR  
CAN GET  
THROUGH.

THEY ALSO KEEP  
OUT LARGER  
DEBRIS THAT  
CAN DENT, CRACK  
OR BREAK  
COMPRESSOR  
BLADES.

## Precleaner

Trees and bushes make a good hiding place for your tank, but they also result in clogged air precleaners.

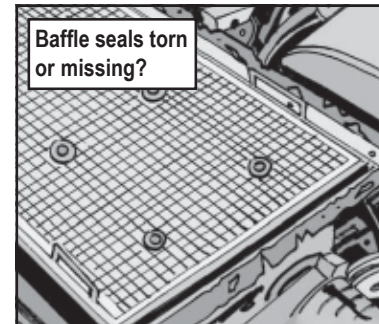
Leaves that fall on or near the air inlets get sucked onto the precleaner. Enough leaves will cut off air-flow and lower power output.



Precleaner  
surface  
clean?

If the AIR CLEANER CLOGGED FILTER light comes on, make the precleaner one of your first checks.

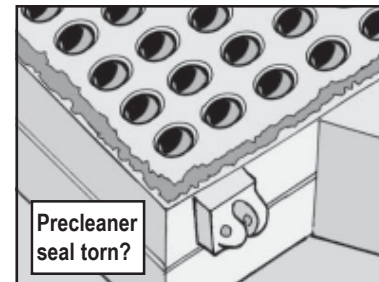
While you're there, take a close look at the baffle seals. Cracked, torn or missing seals allow dirt and oil from the engine to clog the air cleaner assembly element strainers.



Baffle seals torn  
or missing?

NSN 5330-01-225-6106 gets a new short seal. The longer seal is NSN 5330-01-320-3696.

Next, eyeball the bottom precleaner seal. If the seal is missing, loose or torn, replace it. There are two different seals available: NSN 5330-01-166-5798 and NSN 5330-01-329-6614. Check your -24P-1 TM to match the correct seal with your precleaner.



Precleaner  
seal torn?

A NEW SEAL  
IS USELESS,  
THOUGH,  
UNLESS YOU  
PUT IT ON  
RIGHT. HERE'S  
HOW...



1. Clean off the old seal and adhesive completely. To do it right you'll need a lot of elbow grease—combined with a rag, dry cleaning solvent and a wire brush.

2. Spread adhesive, NSN 8040-00-664-4318, in the seal groove. Use enough to hold the seal, but not so much that it squeezes out around the seal. The right amount of adhesive keeps the seal from sticking to the airbox frame and ripping loose every time you remove the precleaner.

3. Apply a very light coat of adhesive to the bottom of the new seal and press it into the groove with your finger. Take extra care not to twist the seal as you put the rounded side in the mounting groove. A twisted seal is not airtight.

4. Let the adhesive dry completely before you put the precleaner back in place. Put a dab of adhesive on a piece of paper. When it's dry, the seal should be, too.

## Skirt Seals

If you're having problems with clogged air cleaner intake filter elements (V-packs), missing fender skirt seals could be the cause. Those rubber strips are there to seal the area between the skirts and hull.

Missing seals let dirt and dust get sucked inside the fender skirts. The engine pulls the dirt into the intake system where it clogs up the V-packs.

All the seals are important, but pay special attention to the seals at skirts 4, 5 and 6 on the left side of the vehicle. These seals are closest to the air intake grills and can let in the most dirt.

NSNS FOR THE SEALS ARE LISTED HERE...

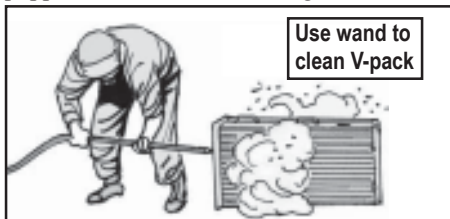
<b>M1</b>	Figs 261-264 and 266 of TM 9-2350-255-24P-1 (Oct 92)
<b>M1A1</b>	Figs 263-266 and 268 of TM 9-2350-264-24P-1 (Sep 01)
<b>M1A2</b>	Figs 242-245 and 247 of TM 9-2350-288-24P-1 (Jul 01)
<b>M1A2 SEP</b>	Figs 241-244 and 246 of TM 9-2350-388-24P-1 (Feb 01).

## V-Packs

The three V-packs on all tanks not equipped with the pulse jet system (PJS) should be removed, cleaned and inspected after every operation in dusty, sandy desert conditions. V-packs on PJS-equipped tanks are self-cleaning.

The preferred cleaning method is the V-pack cleaning wand. You'll find info on the wand in the "unusual conditions" section of your -10-2 TM's operating instructions.

If the cleaning wand isn't available, shake the V-packs, making sure not to hit them against anything harder than your hand. Brush dirt and dust from the elements with your hand. Then, have the elements properly cleaned by your unit maintenance folks as soon as possible.



WHILE THE V-PACKS ARE OUT, INSPECT THE PLENUM BOX AND ELEMENTS FOR POTENTIAL PROBLEMS...

Look for dents or buckling

- Eyeball the bead on the front face of each V-pack element for dents or sharp edges that could cut the plenum box seal. Then check for buckling on the rear face of the element. Either problem means you need a new V-pack.
- Look for broken welds and cracks in the plenum air box. Dust trails along the welds and seams of the box are a good sign of a leak, so tell your mechanic.
- Look for torn, cracked or missing plenum box seals. A missing seal makes your tank NMC.

Those three seals also deteriorate over time, so check each one by measuring the depth of the depression made by the V-pack bead in the seal. If the depression measures more than 3/16 inch, get the plenum box seal replaced.

HERE'S ANOTHER WAY TO CHECK THE SEALS...

1. Apply chalk to the raised portion of the V-pack bead.
2. Install the V-pack and secure the holding clamp.
3. Remove the V-pack and eyeball the plenum box seal. There should be a complete chalk line around the seal from contact with the V-pack bead.

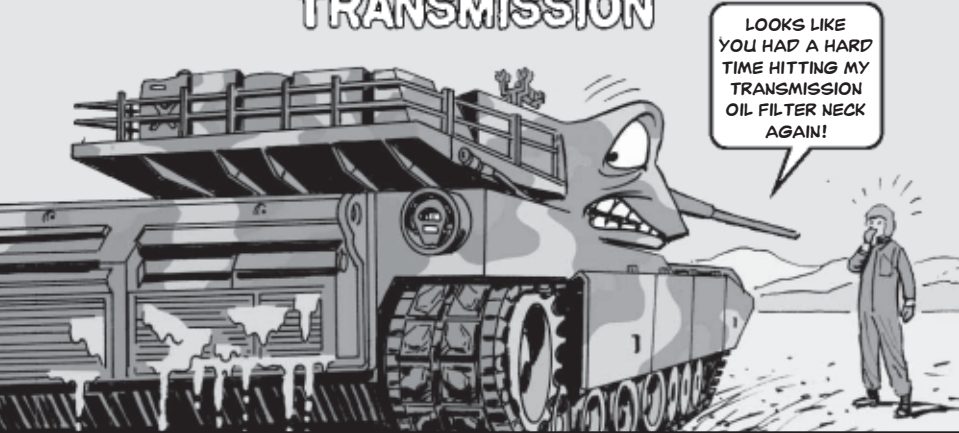
Chalk placed here...

...should show up here

If the chalk line is broken, the V-pack may not be sealing correctly. So, get your mechanic to install a new seal, NSN 5330-01-098-6807. Remember to wipe the chalk off the V-pack bead and seal after testing.

This method works especially well if you are putting new V-packs in **without** replacing the plenum box seals. But, it's a good idea to put in new seals along with the new V-packs whenever possible.

# SPILLED OIL DAMAGES TRANSMISSION



Transmission oil belongs in your tank's transmission, not sprayed all over the engine.

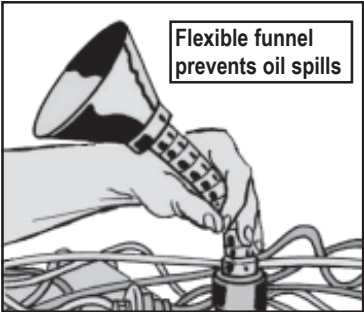
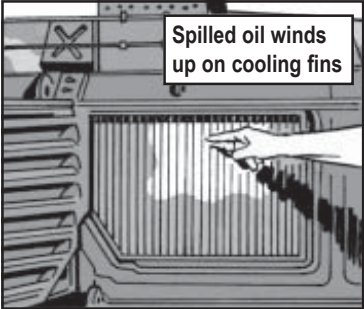
Unfortunately, the filler neck is so small that spills often happen. A lot of that spilled oil gets blown by the cooler fans onto the oil cooler fins.

That oil residue attracts dirt and dust like a magnet. The gooey mess that forms on the cooling fins won't let the heat radiate away from the oil inside the coolers. That results in transmission damage.

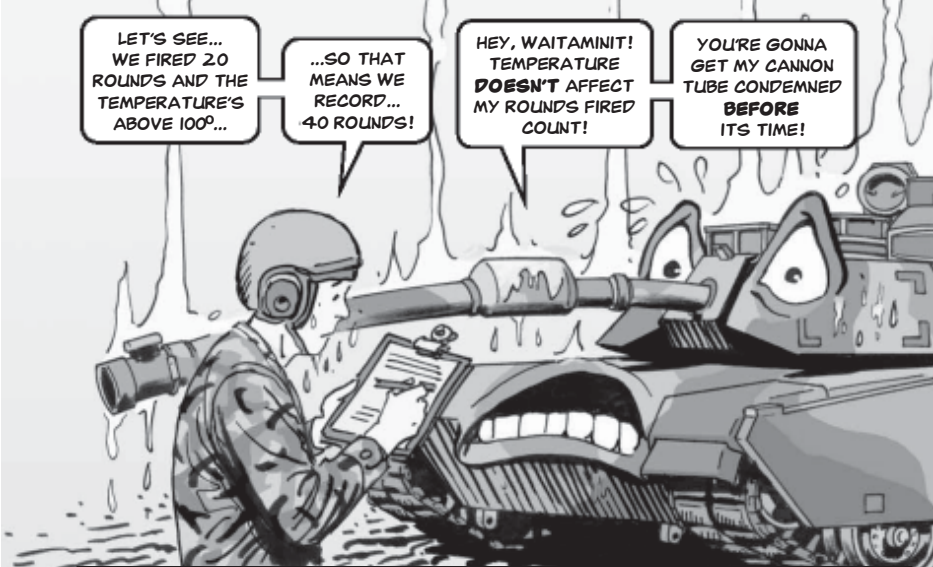
Never add oil without a funnel. If your tank's oil funnel tip is broken or too large for the filler opening, get a new funnel.

A flexible funnel does the best job. NSN 7240-00-559-7364 brings a box of 12.

Each funnel holds one quart, so use it carefully. Don't pour more than a quart into the funnel at one time or it'll overflow. If that happens, wipe up any spilled oil right away.



# DON'T RETIRE TUBE TOO EARLY



The M256 cannon tube on your M1A1/A2 tank isn't cheap, crewmen, so don't replace it before you have to.

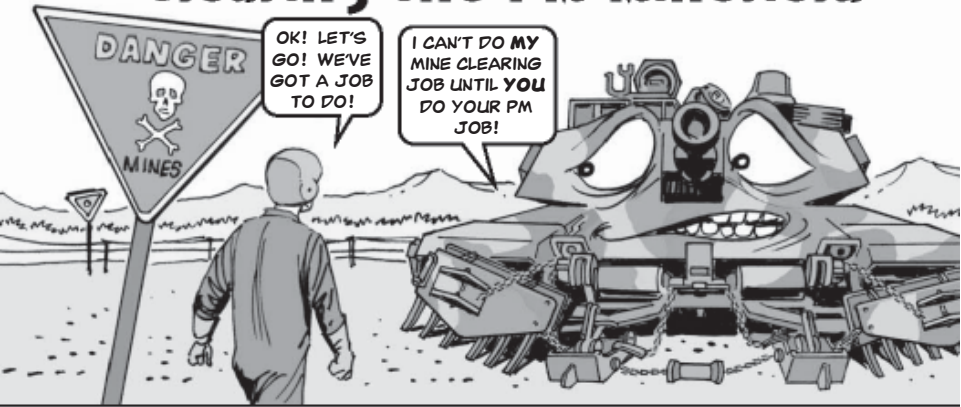
When do you have to?

The safe service life of the M256 cannon tube is 1,500 equivalent full charge (EFC) rounds. For some cannon tubes, when the ammunition's ambient temperature rises to 100°F or higher, the EFC count increased from one to two for each round fired.

There is no temperature sensitivity for M256 ammunition, so its EFC count remains at one regardless of the temperature. See Page B-5 of TM 9-1000-202-14, *Evaluation of Cannon Tubes*, for the straight scoop.

Don't mistakenly enter the wrong number of rounds on the DA Form 2408-4, *Gun Record Card*, just because it's hot outside. If you do, the tube will be condemned too early.

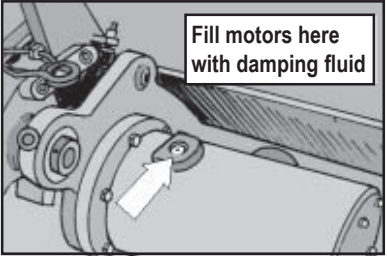
# Clearing the PM Minefield



It takes regular doses of PM to keep your tank's mine clearing blade out of a maintenance minefield. Follow the good words in TM 9-2590-509-10, then dig a little deeper to unearth these PM tidbits:

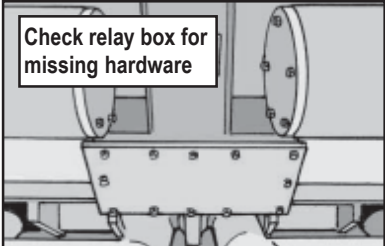
### Motors

If the blades come crashing down when the electrical or manual blade release is used, too little oil or oil contamination could be the culprit. Use the electrical switch to raise and lower the blades once more. If they come crashing down again, have your mechanic drain the old oil from each motor and replace it with four ounces of damping fluid, NSN 9150-00-607-0897.



### Water Damage

Heavy rain or high-pressure water can seep into the relay box if any of the cover assembly bolts are missing or if the cover seal is missing or damaged. Water buildup causes electrical shorts.



Your mechanic can replace a missing or damaged seal with NSN 5330-01-277-5647. New bolts come with NSN 5305-00-269-3235. NSN 5310-00-637-9541 gets new lock washers.

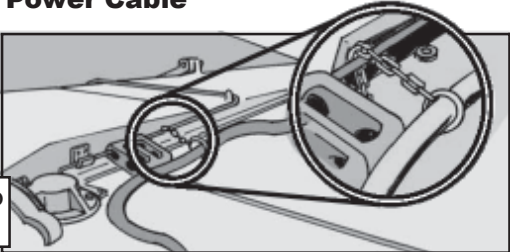
### Depth Adjustment

When you're training with the mine clearing blade, keep the adjusting plate set at its shallowest depth—eight inches. That prevents damage to your tank's engine and the blade's teeth.

### Power Cable

Make sure the power cable is secured to the fender torsion bar. That keeps the cable from getting pinched when the driver's hatch is opened.

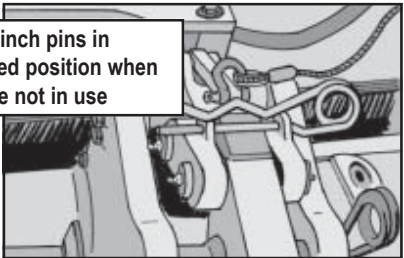
Secure power cable to fender torsion bar



### Travel Lock Linch Pins

The travel lock linch pins, NSN 5315-01-382-5953, should be put in the locked position whenever the mine clearing blade is not in use. That keeps the blade from being accidentally dropped while the tank is moving.

Put linch pins in locked position when blade not in use



Before starting mine clearing operations, move both pins to the stowed position so the blade can be lowered.

Move pins to stowed position for plowing

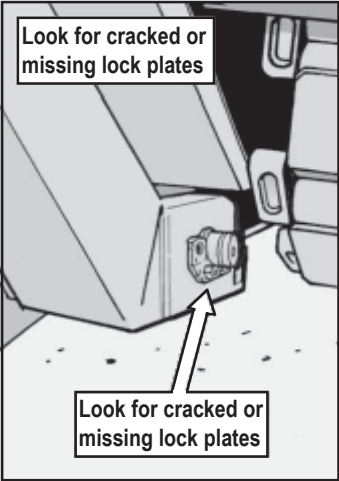


### Locking Plate

Keep a close eye on the locking plate, NSN 2590-01-277-5628, for the blade's mounting pins. These C-shaped plates are under a lot of stress and can crack or break.

Look for cracked or missing lock plates

Look for cracked or missing lock plates



Without 'em, the mounting pins slip out and the blade comes loose from the mounting frame.

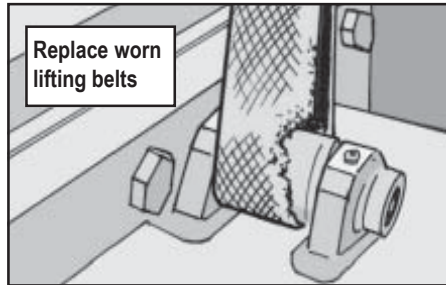
## Lifting Belts

Take care of the mine clearing blade's lifting belts and they won't let you down. That means using the right lifting techniques.

During operations, always make sure you back the vehicle 8-10 feet before lifting the blades. That keeps the blades from hanging up on anything that'll snap the belts.

Never use the mine clearing blade to recover mired vehicles or to lift anything. Either the lifting belts will break or the motors will burn out.

Never drive the blade through concertina wire. It'll nick and cut the belts. When that happens, your mechanic has to replace them with new belts, NSN 4020-01-289-8249.

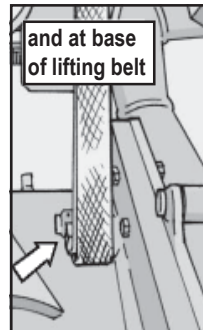


## Lubing

There are only six lube points on each side of the mine clearing blade, but they still get missed.

There are four lube points on each of the travel lock assemblies. The rest are at the base of the lifting straps.

Give each of these lube points a good shot of general purpose aircraft grease after every operation. NSN 9150-00-145-0268 brings a 5-lb can of the grease.

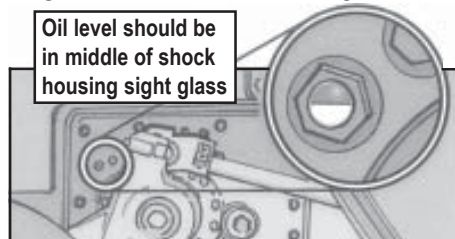


## Don't Forget the Tank

Now that you've got the mine clearing blade checked out, don't forget the tank.

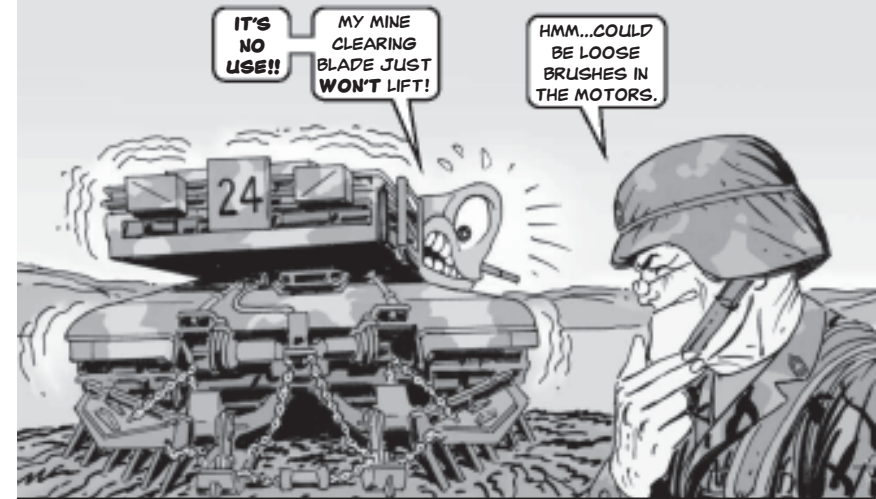
The blade's weight puts a lot of extra stress on your tank's suspension system, so check the shock absorber housings for leaks each time you stop. If the fluid level is low, add lubricating oil, NSN 9150-01-439-0756, until it reaches the half-way point in the sight glass.

Never park your tank with the mine blade in the travel position for an extended period. Lower the mine blade to the ground.



## M1-Series Tanks...

# BRUSH UP ON MINE BLADE REPAIRS



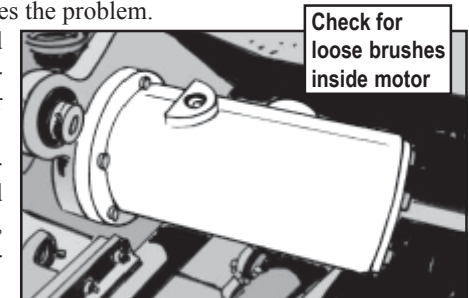
The mine clearing blade on an M1-series tank won't be clearing much of anything if the lifting mechanism, NSN 2590-01-277-0060, isn't working, mechanics.

But before your unit pays more than \$7,000 for a new lifting mechanism, consider this: Every part is replaceable. You'll find them listed in Fig C-3 of TM 9-2590-509-23&P.

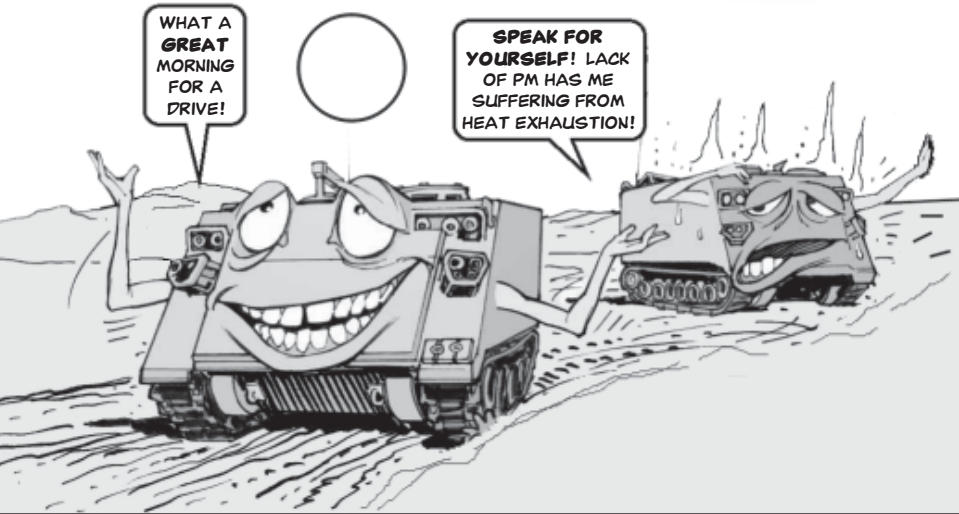
The number-one lifting mechanism problem is loose electrical brushes in the motors. That's especially true if the operator does a lot of "combat drops" or changes the motors' direction without first letting the mine blade come to a complete stop. Reinstalling the brushes usually fixes the problem.

If not, the brushes may be burned out. Install new brushes, NSN 5977-01-412-0758. You'll need four brushes for each motor.

If the motors, NSN 6105-01-502-9448, still won't work, you may need to replace them. At \$3,500 each, that's still a lot cheaper than ordering a new lifting mechanism.



# STOP HEAT EXHAUSTION



WHEN IT GETS HOT OUTSIDE, IT'S A LOT HARDER TO KEEP YOUR M113A2 CARRIER COOL ON THE **INSIDE**.

FACT IS, **OVER-HEATING** IS A LEADING CAUSE OF ENGINE DAMAGE.

BUT NO MATTER HOW HIGH THE TEMPERATURE GOES, PM IS STILL THE **BEST** WAY TO KEEP YOUR VEHICLE RUNNING COOL.

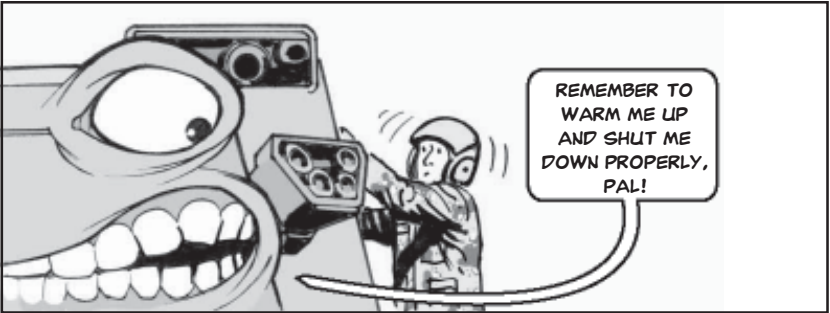
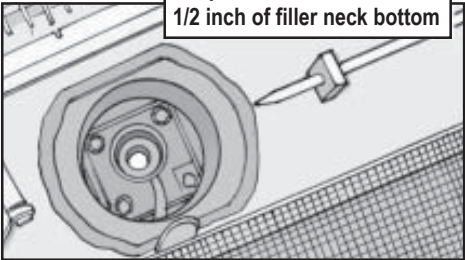


## Coolant Levels

If you operate with low coolant levels, the engine overheats and is ruined. So take a look at the coolant level daily before operation. Be sure coolant is within 1/2 inch of the bottom of the filler neck. Keep the level up at **all** times.

If the coolant level is low, have your mechanic give the system a complete inspection for leaks.

Keep coolant level within 1/2 inch of filler neck bottom

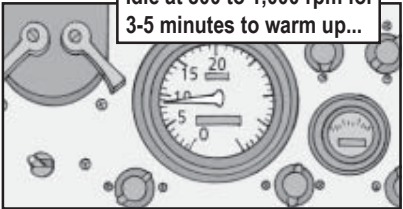


## Engine Warmup

Your engine will last longer if you always warm it up before you move out. Oil drains out of bearings when the engine is at rest. You need to give the oil time to circulate before you move your carrier.

After you start the engine, check the ENGINE OIL HI TEMP LO PRESS warning light. Make sure it goes out within 10 seconds. Then, set the hand throttle between 800 and 1,000 rpm and let the engine run for 3-5 minutes. That lets the coolant and engine oil warm up.

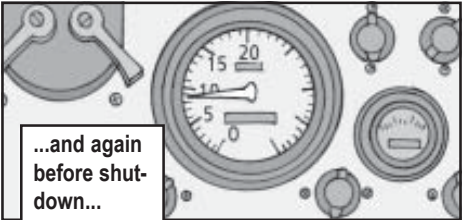
Idle at 800 to 1,000 rpm for 3-5 minutes to warm up...



## Engine Shutdown

Before you shut off the engine, run it in neutral at 800 to 1,000 rpm until you get a normal idle temperature of 160-180°F on the TEMP gauge. Then, set the engine back to idle (650-700 rpm) for a few seconds. Finally, pull the fuel cut-off handle to shut down the engine.

...and again before shut-down...

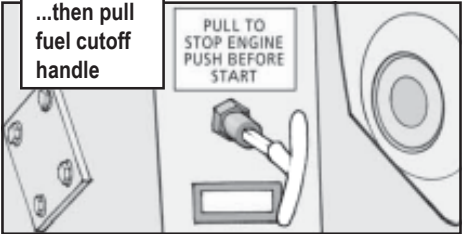


...then pull fuel cutoff handle

**SHUT DOWN PROPERLY OR YOU MAY BE SHUTTING DOWN PERMANENTLY!**



PULL TO STOP ENGINE PUSH BEFORE START



## Air Cleaner

Your engine will lose power and overheat if the air cleaner element is choked with dirt. If the air cleaner restriction indicator shows red in the window, clean or replace the element.



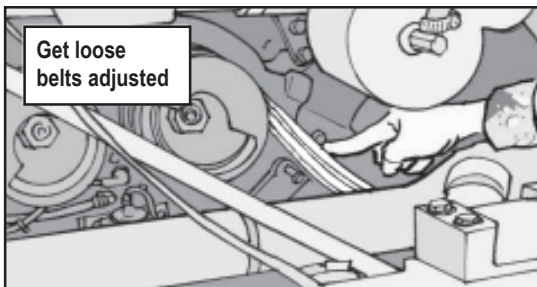
## Belts

The fan and generator belts can contribute to engine overheating, too.

When the belts get too loose, the fan and the coolant pump can't operate fast enough to keep the engine from overheating.

Check the belts by pushing on them halfway between the pulleys. If you can push either belt more than 5/8 inch, get your mechanic to adjust them.

Check the idler adjuster rod, too. If the rod is not between the operating range marks, tell your mechanic.

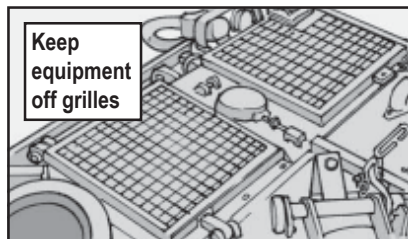
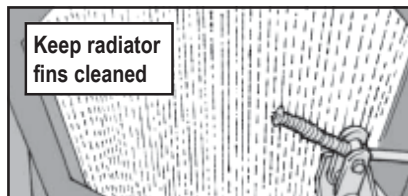


## Radiator Fins

Your radiator can't do a good job of conducting heat if its fins are clogged with dirt, oil, leaves, grass or twigs. Anything that restricts airflow through the radiator keeps the coolant hot and overheats the engine.

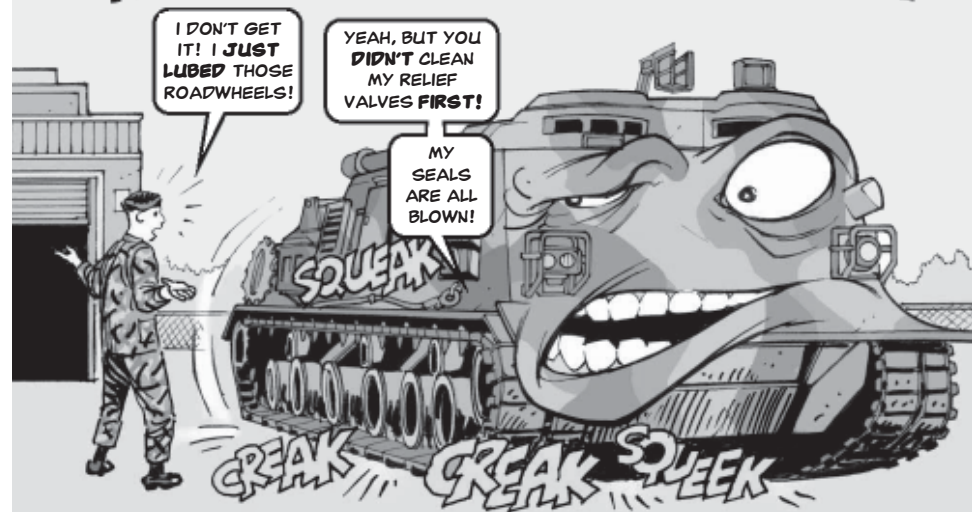
Keep your equipment—packs, water cans, tents, camouflage screening, poles, etc—off the air intake and the air exhaust grilles. Make sure both are clean and free of dirt, twigs, leaves and other debris.

If you use protective covers over the grilles, make sure they're rolled up and strapped in place before you operate your vehicle.



## M88A1 Recovery Vehicle...

# RELIEVE THE PRESSURE



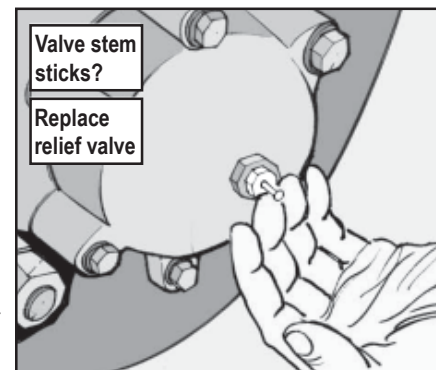
Most people don't work well under a lot of pressure. The same holds true for the roadwheels on your M88A1 recovery vehicle, crewmen.

A roadwheel relief valve that's clogged with dirt and sand won't relieve pressure when you pump in new grease. The pressure grows until something gives—usually the hub seal.

When the seal goes, so does the lube. The result is burned-out bearings.

So before adding new grease, use a cloth to wipe away any dirt and sand from the relief valve. Then pull out on the valve stem.

If it slides out smoothly and pops back in when you release it, the valve's OK. If it doesn't, replace it with relief valve, NSN 4820-01-070-7670.



AIR BOX NEEDS A BLOWOUT



If it has been a while since you’ve cleaned the air cleaner boxes in your howitzer or ammo carrier, they need your attention now.

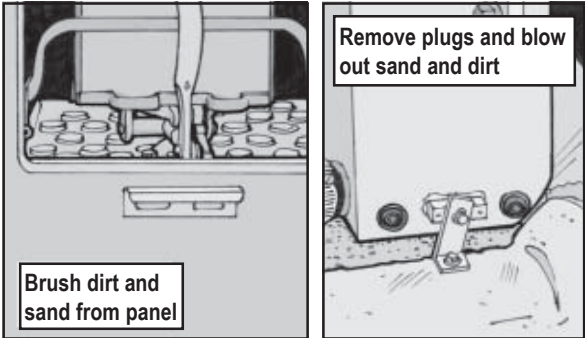
That’s because dust and grit collect all over the boxes even under normal conditions. During the heat and dust of the desert, things just get that much worse. The air induction system exhaust fans just can’t remove all the dust and grit.

So, next time you pull the air filters for cleaning, clean the air boxes, too.

First, brush off any dirt on the panel under the air filter. Next, open the two plugs at the base of each air box and blow out all the dirt and sand with low-pressure air—no more than 30 psi. You have to remove the blower motor hose bracket to get to the plugs on the Paladin’s left air box.

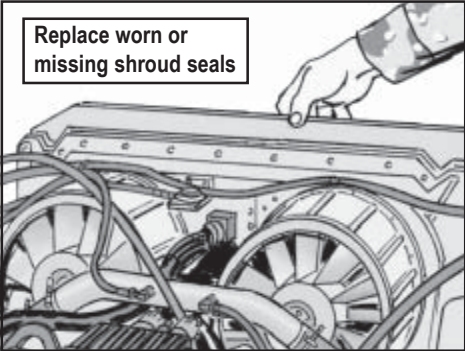
If the dirt and sand have hardened—which is what happens when water gets mixed in—you’ll probably have to break up the mess with a knife or screwdriver before blowing it out.

**Never** clean the boxes by hosing them out with water. That leads to rust, which causes even more clogging problems.



Got a hot-running engine in your M109-series howitzer or M992A2 ammo carrier? There’s a good chance the radiator shroud seals are to blame.

Those seals form an air barrier between the radiator and fan tower. That barrier increases air flow through the radiator to keep the engine cool. If seals are missing, torn, squashed or mangled, air escapes around the sides of the radiator. Engine temperature goes up.



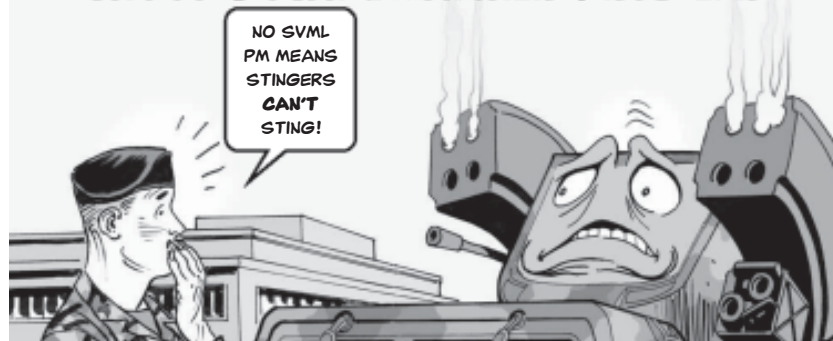
Have your mechanic check out the shroud seals next time the pack’s out. If the seals are missing or damaged, he’ll order new ones.

NSN 5330-00-102-9927 gets a seal for the right or left side. NSN 5330-01-314-1439 gets a top or bottom seal for the M109A6 and the M992A2. A top or bottom seal for the M109A2-A5 comes with NSN 5330-00-899-5220.

# Missile Systems

Avenger Missile System...

## SHOOT DOWN LAUNCHER PROBLEMS



An Avenger with a standard vehicle-mounted launcher (SVML) in bad shape isn't going to sting many enemy aircraft. But you can shoot down many launcher problems with PM.

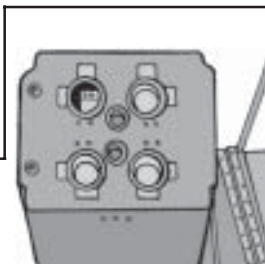
### Be Clean

Just a little dirt and moisture can be fatal to your SVML's cryogenics or electronics. They cause firing problems or even no firing. So think clean and dry.

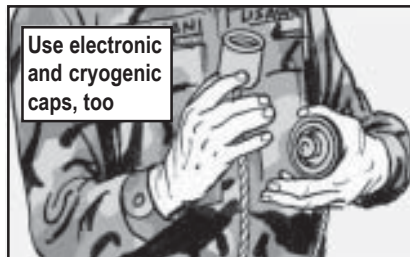
The best way to seal out dirt and moisture is to use the SVML protective caps as much as possible, especially during travel. The caps are cheap, so order plenty of extras. The rear caps come with NSN 5340-00-855-7993, the front caps with NSN 5340-00-157-5624, and the caps for the pressure gauge holes with NSN 5340-01-348-6514.

It's also important to use the caps for the SVML cryogenic and electronic ports as much as possible to further seal out dirt and moisture. Order replacement cryogenic caps with NSN 5340-01-466-1897 and the electronic caps with NSN 5340-01-466-1898.

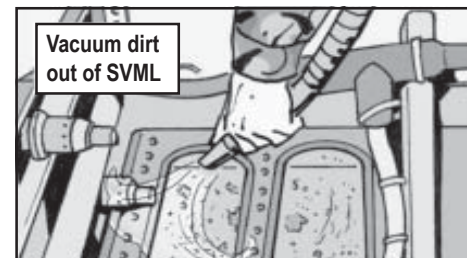
Use caps to seal out dirt and moisture



Use electronic and cryogenic caps, too



Letting dirt build up inside the SVML isn't going to help keep dirt out of the cryogenics or electronics. Whenever you notice much dirt, use a shop vac to suck it up. Of course, keep the SVMLs closed as much as possible to keep out dirt.



### Coolant Reservoir Bottles

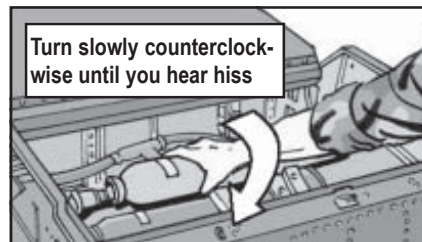
Remember that the coolant reservoir bottles are under 6,000 pounds of pressure. When you're installing a bottle in an SVML, make sure nobody is standing behind the launcher. A bottle can take off like a rocket if its coupling malfunctions.

All that pressure can cause leaks if you leave the bottles hooked up when the Avenger sits for weeks in the motor pool. To release the pressure on a bottle, just open its quick-release clamp and turn the bottle three times counterclockwise until you hear a hiss. Then close and latch the quick-release clamp. Don't let anybody stand behind the launcher while you do this.

Keep people away from rear of SVML when installing coolant bottle



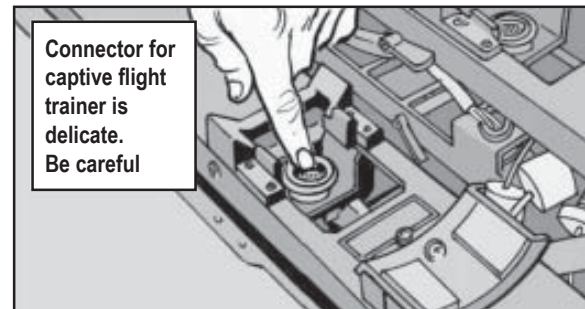
Turn slowly counterclockwise until you hear hiss



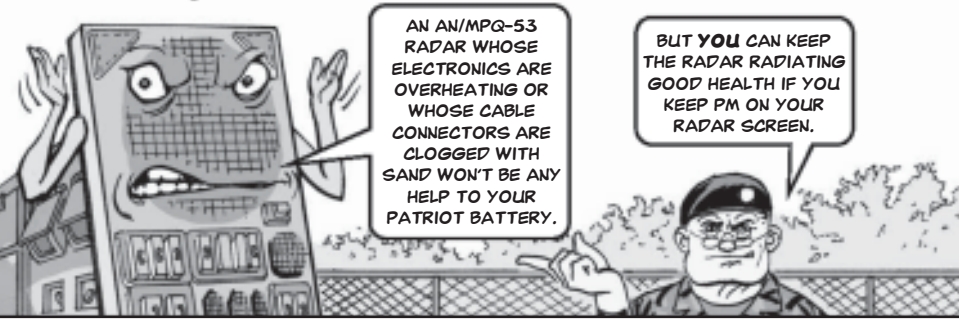
### Captive Flight Trainer

Be careful plugging in the captive flight trainer. The SVML connector has delicate pins. If you muscle the trainer connector on and bend the pins, it's an expensive and lengthy procedure to replace the SVML connector.

Connector for captive flight trainer is delicate. Be careful



# Keep PM on Your Radar Screen

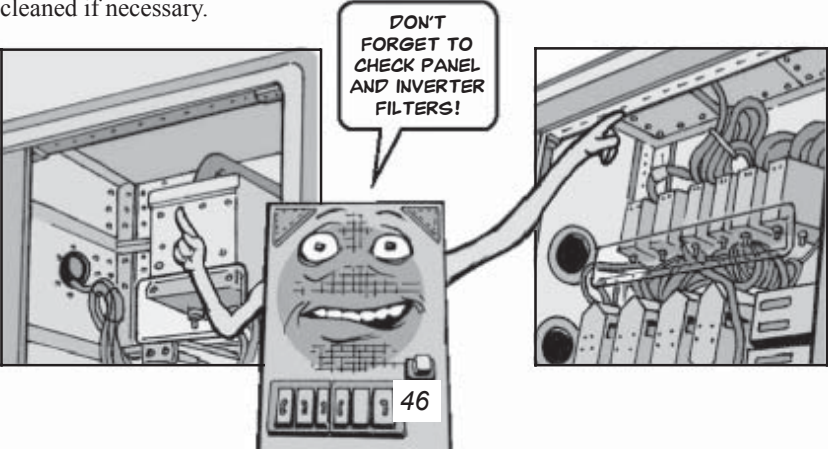
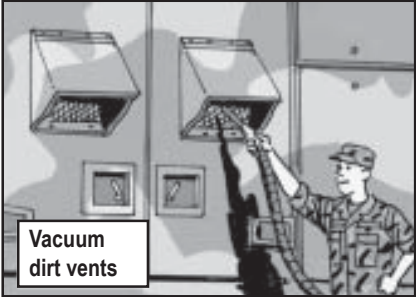


## Fresh Air

The AN/MPQ-53 needs plenty of fresh air to keep its electronics from overheating, especially in the desert. That makes filters Job No. 1 during maintenance.

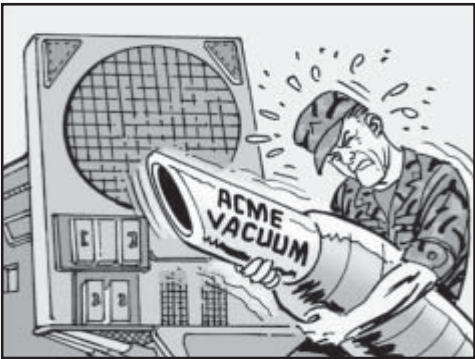
At least monthly (every other week in the desert), check all eight vent screens for dirt. Vacuum them if necessary. Before powering up the radar, make sure every vent is open.

The radar's two **A100 distribution box power panel** filters, the **A122 control logic panel excitor** filter and the filters behind the **inverters** are almost always forgotten. They should be checked monthly (every other week in the desert) and cleaned if necessary.



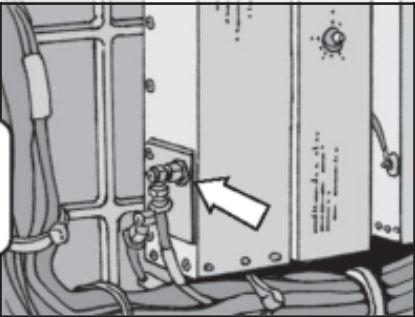
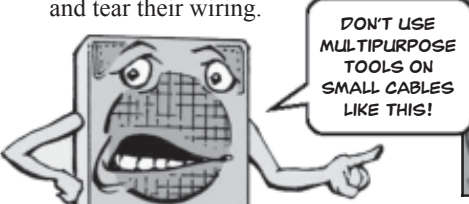
Filters will stay clean longer if you keep radar doors shut as much as possible and weekly vacuum inside the radar. Dust lying on the floor will be sucked into the air system.

The IFF cabinet also becomes clogged with dirt and its circuit cards overheat. Weekly, wipe dirt off the IFF cabinet and follow the rest of the PMCS in TM 11-5895-824-12.

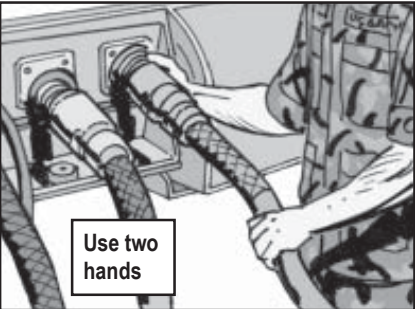


## Cable Care

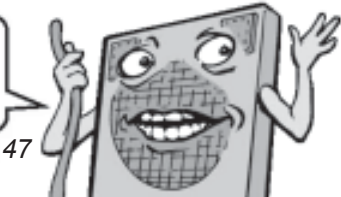
Inside the radar are numerous slender cables that require the proper wrench. If you use your multipurpose tool on them, you can twist the cables and tear their wiring.



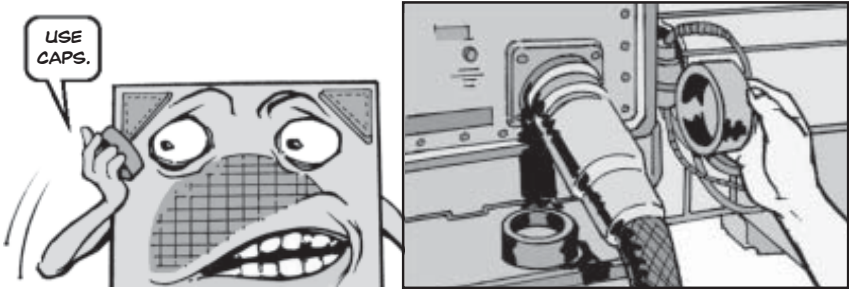
It's a different story with the big J1, J2, and J3 cables. They require two hands. If you twist cables on or off one-handed, you rip the wiring. And they're expensive. So use one hand to support the cable and take the weight off the connector. Use the other hand to turn the connector until it disconnects. Pull it straight off. Don't let the cable slam to the ground. It can't take the hit.



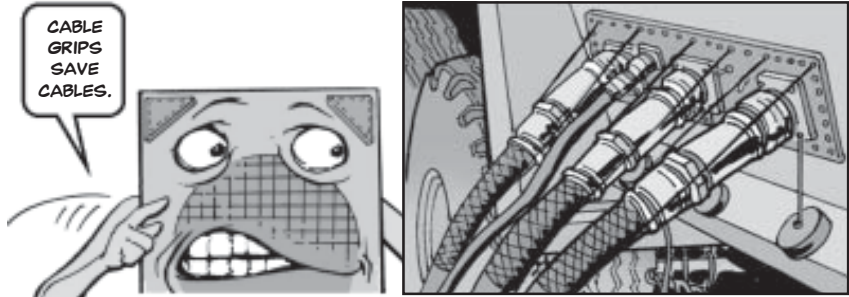
SUPPORT THE CABLE WITH ONE HAND WHILE UNSCREWING THE CONNECTOR. THEN LAY THE CABLE DOWN.



Cap the cables and radar connectors as soon as you disconnect cables. Otherwise, dirt and sand clog the connectors. If the caps have disappeared, tell your repairmen and wrap the connectors in plastic.

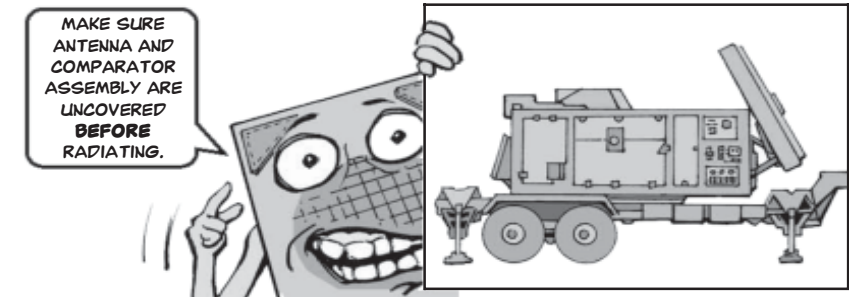


Cable grips will help these big cables last by supporting the cables' weight. Order grips with NSN 5120-01-213-9538.

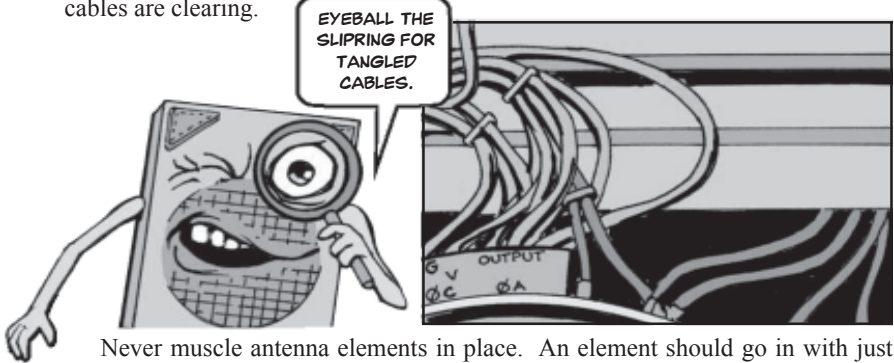


### Radiating

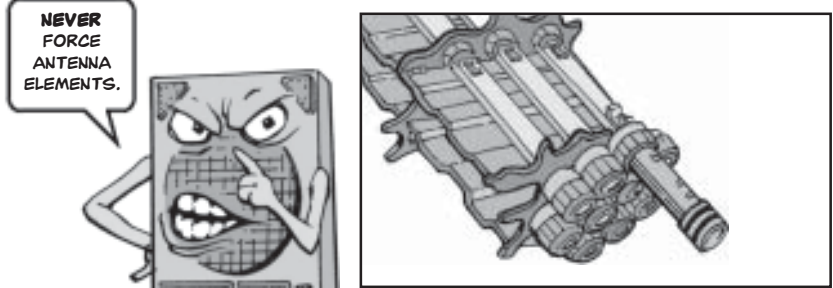
Before you radiate, double check that the covers have been removed from the comparator assembly and the antenna. If a cover's left on, it reflects the RF energy back down the wave guide and the radar becomes a microwave oven, cracking or damaging the waveguide window and other components.



Any time you're rotating and lose power, don't power up again until you inspect the slipring for tangled cables or arcing. A cable may have fallen out of the cable tray or the tray itself may be loose. If you continue to operate, cables rip out or the whole slipring burns up. Check by manually rotating the radar to see if the cables are clearing.



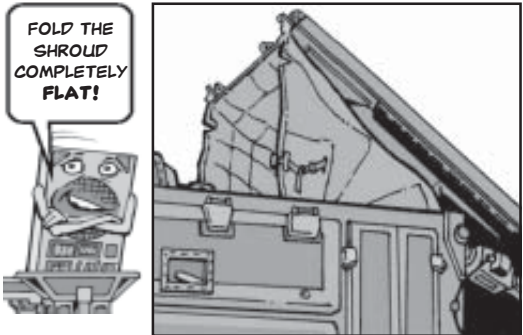
Never muscle antenna elements in place. An element should go in with just slight pressure. If it doesn't, turn the element and try again. Forcing bursts the antenna socket. The whole antenna has to be taken apart to fix one socket.



### Hitting the Road

Before you hit the road or traverse, make sure all doors are latched and shut. If you forget just one door, it can be torn off and then the electromagnetic interference shield is ruined.

Fold the shroud completely flat before you lower the radar. If it is bunched up, it can damage the roof covers.



# Small Arms

Small Arms...

Stop  
Sand from  
Stopping  
You

WHAT'S  
WRONG?  
WHY WON'T  
YOU FIRE?

SAND CAN **STOP** YOUR  
RIFLE, MACHINE GUN, OR  
PISTOL FROM **FIRING**.

SAND BLOWS IN  
PLACES LIKE THE  
MUZZLE AND EJECTION  
PORT AND STOPS  
MOVING PARTS.

EVEN  
WORSE, IT  
MIXES WITH  
LUBE...

...AND FORMS  
A **SCOURING  
POWDER**  
THAT GRINDS  
UP PARTS.

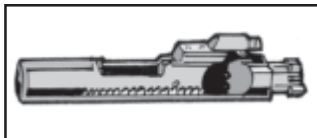
STOP SAND FROM  
STOPPING YOU AND  
YOUR WEAPON BY  
PAYING ATTENTION  
TO A FEW RULES...

**"CLEAN YOUR GUN OFTEN.**



THAT MEANS AT LEAST  
DAILY IN THE DESERT.  
SOMETHING AS QUICK  
AS WIPING OFF THE  
OUTSIDE OF YOUR GUN  
WITH A CLEAN CLOTH  
EVERY CHANCE YOU GET  
WILL HELP. CLEANING  
THAT INVOLVES  
DISASSEMBLY SHOULD  
BE DONE ONLY IN  
ENCLOSED AREAS, LIKE  
YOUR TENT.  
OTHERWISE, BLOWING  
SAND WILL DEFEAT  
YOUR CLEANING."

**"PAY SPECIAL ATTENTION TO MOVING PARTS  
LIKE THE BOLT CARRIER.**



WIPE AND BRUSH THEM  
CLEAN. BLOW OUT  
SAND FROM AREAS LIKE  
THE TRIGGER  
ASSEMBLY THAT  
YOU'RE NOT ALLOWED  
TO TAKE APART."



PPFT!  
THAT'S IT  
FOR ME!  
PFFP!

PHHPT! SAND  
HAS **STOPPED** MY  
MOVING PARTS  
FROM MOVING!

**"EASY ON LUBRICATION.**



LUBRICANTS LIKE CLP  
ATTRACT SAND.  
CORROSION IS NOT A  
BIG PROBLEM IN THE  
DESERT, SO YOU DON'T  
NEED AS MUCH LUBE.  
LUBE ONLY INTERNAL  
PARTS. WIPE THE OUT-  
SIDE OF THE  
WEAPON  
DRY."

ALL THIS LUBE  
HAS MADE ME  
A **SAND  
MAGNET!**

**"CLEAN MAGAZINES.**



MAGAZINES JAM WITH  
SAND. UNLOAD AND  
WIPE OFF AMMO DAILY.  
RUN A RAG THROUGH  
THE MAGAZINE. DON'T  
PUT ANY LUBE IN  
MAGAZINES OR ON  
AMMO."

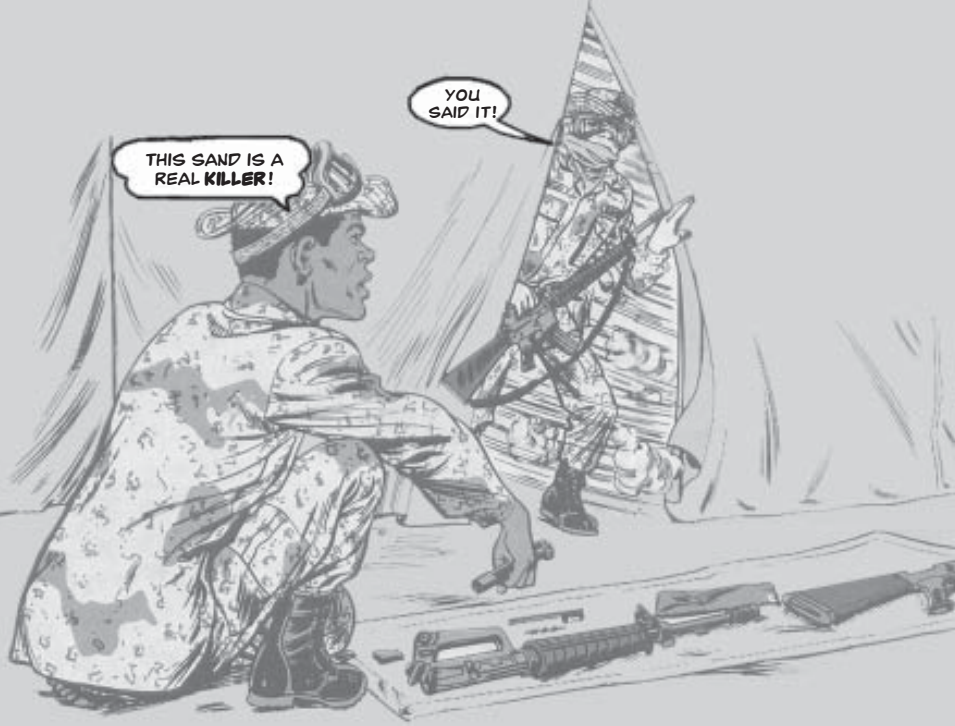
I LIKE A  
**CLEAN  
MAGAZINE** IN  
THE DESERT!

**"USE RIFLE COVERS,  
MUZZLE CAPS, AND  
SPARE MAGAZINE BAGS.  
COVER MOUNTED MACHINE GUNS. KEEP  
THE M16/M4'S EJECTION PORT COVER  
CLOSED AND A MAGAZINE INSTALLED."**



ARE YOU  
**SURE** THIS  
WILL PROTECT  
ME FROM  
SAND!?

## Shootin' in the Desert



You know the standard rules for taking care of a rifle, pistol, or machine gun in the desert:

- Clean your gun twice as often.
- Pay special attention to the surfaces of moving parts like the bolt carrier.
- Lube only internal parts.
- Wipe down the outside of your weapon as much as possible.

But there are some additional tips for your M16 or M4/M4A1:

Use the protective dust cap, NSN 5340-00-880-7666, the 30-round magazine bag, NSN 1005-00-193-8306 (that gets 500 bags), and M16 rifle cover, NSN 1005-00-809-2109, as much as possible to keep dirt out of the weapon and magazines.

Keep your ammo clean and clean the magazines before using them. Wipe out the magazines with a dry cloth and check for any damaged parts. But don't lube magazines. Lube attracts dirt and sand.

## NBC Equipment

M40-, M42-Series Masks...

## When Must Canisters Be Changed?



*Dear Half-Mast,  
How often must NBC  
NCOs change the canisters on the M40/M42-series masks in order to protect soldiers from agents like anthrax?*

*SFC J.P.*

*Dear Sergeant J.P.,*

*If you're operating where there have been no chemical attacks and no blood agent CK (cyanogen chloride) threat, change the canister annually.*



*In an area with no confirmed chemical attacks but a CK threat in a climate that's cold and humid or warm and moderately humid, change the canister annually. Change it every 39*

*weeks when it's hot and dry. Change it every 10 weeks when it's hot and humid.*

*For units that have experienced chemical attacks, change the canister every 30 days.*

*Whenever a soldier has trouble drawing breath through the canister, it should be changed.*

*For more information, see FM 3-4, NBC Protection. If you don't have a copy, your pubs clerk can order it with IDN 110736 and PIN 058794.*

*SB 3-30-2, Canister and Filter Elements (Serviceability Lists), has info on which canisters are still good. It's part of EM0045, the CD-ROM that contains most of the NBC TMs. Unopened canisters have a 5-year renewable shelf life.*

*Half-Mast*



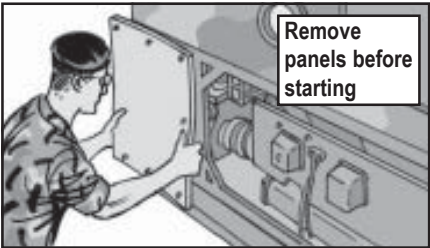
The M12A1 decon generates lots of heat while it operates, so you have to keep it cool while it's running and let it cool off before you shut it down. Otherwise, it can suffer major damage, like warped pistons. So think cool.

Thinking cool begins with “panels off, shroud on.” If the side panels are left on while the M12A1 is running, heat can’t escape. So before start-up, remove all five panels.

But keep the engine shroud latched in place. It directs cool air around the engine for efficient cooling.

But the shroud won’t do much good if it doesn’t fit—and new shrouds don’t fit. The shroud wasn’t designed for the M12A1. Support can make it fit by using the info on Page 2-77 in TM 3-4230-209-30&P.

Remember to adjust the engine air control handle to the outside temperature.

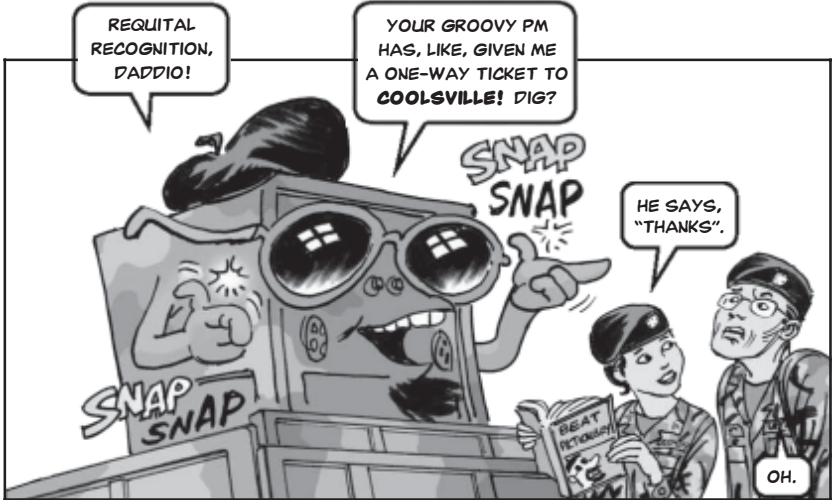
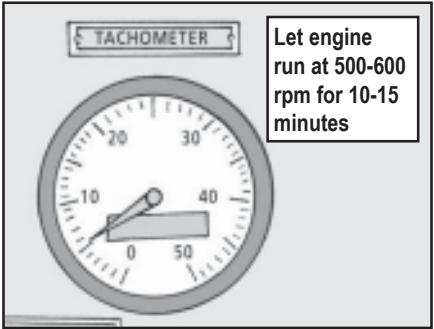
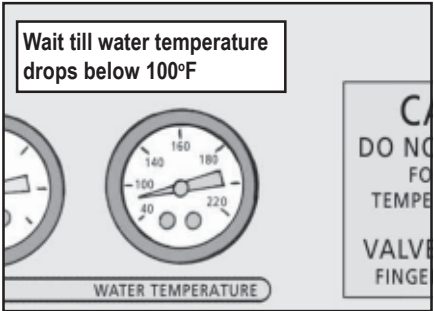


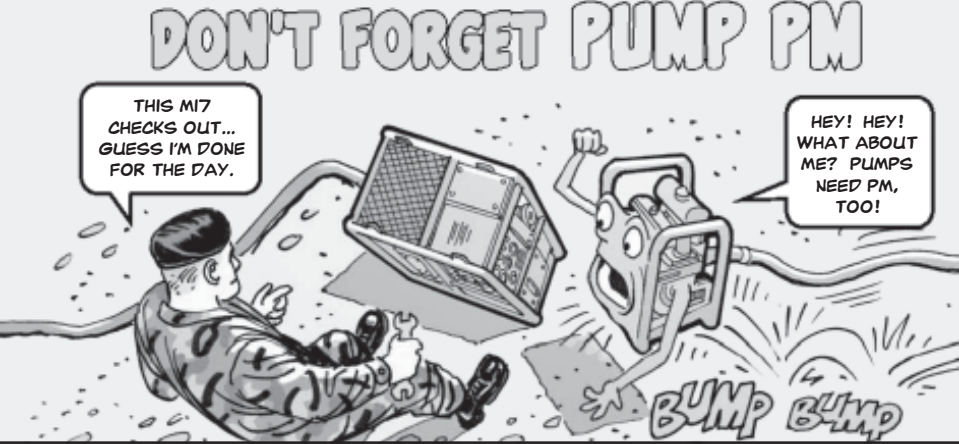
**Shutdown**

To shut down the heater unit, put the heater switch in the PURGE ON position. Let the heater run for 2 minutes after combustion stops, then turn the heater receptacle switch on the pump to OFF.

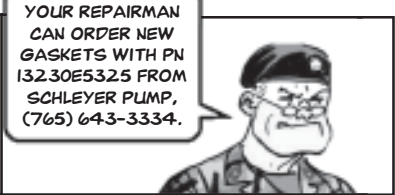
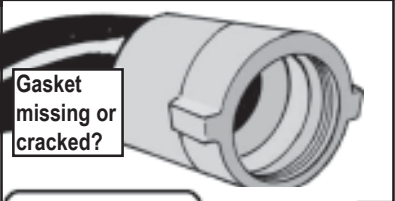
Check the heater’s water temperature gauge. If the temperature is above 100° F, continue to cycle water through the boiler until the temperature drops. Once it’s below 100°F, it’s safe to shut off the heater.

Give the pump engine a chance to cool off, too. Let the pump idle for 10-15 minutes at 500-600 rpm. Then shut down the pump by turning the FUEL-SHUT OFF valve before you move the starter switch to STOP. Otherwise, fuel collects in the carburetor. Next time you start the engine it could backfire and burn somebody—or the engine won’t start at all.





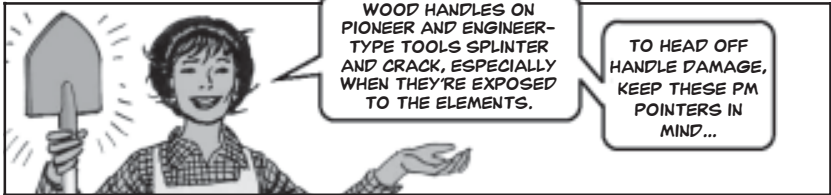
**BEFORE** YOU GO TO THE FIELD, CHECK **BOTH** THE INLET AND OUTLET HOSE CONNECTORS FOR GASKETS. IF A GASKET IS MISSING OR CRACKED, THE PUMP CAN'T BUILD UP ENOUGH PRESSURE TO PUMP WATER.



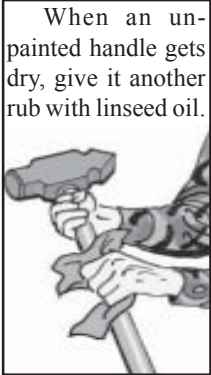
**IN THE FIELD**, DON'T FASTEN EITHER HOSE MORE THAN HAND-TIGHT. IF YOU OVERTIGHTEN EITHER HOSE, YOU'LL STRIP THE THREADS. THAT'S THE LAST TIME YOU'LL BE ABLE TO FASTEN THAT HOSE TIGHT.



# Soldier Support



- If the handle is on a tool stored outside, paint it to protect against weather.
- Follow the local SOP for paint color, usually the same as the vehicle's basic color—but not in camouflage pattern.
- If the handle is on a tool kept inside, rub it with linseed oil. That'll prevent drying, cracking and splintering. Order a gallon of linseed oil with NSN 8010-00-152-3245.



Soldier Support...

# PREPARING FOR THE DESERT



HEADED FOR AN NTC ROTATION OR BEING DEPLOYED TO SOME OTHER DESERT LOCATION? THEN TAKE A LOOK AT THE LIST OF ITEMS HERE.

SOME JUST COME IN HANDY; OTHERS CAN MAKE A VERY UNCOMFORTABLE SITUATION A LOT MORE TOLERABLE.



Item	NSN	Qty/Size
Chapstick	6508-01-436-0607	144 sticks
Hydrogen peroxide	6505-00-153-8480	1 pint
Adhesive bandage strips	6510-00-597-7469	100 3/4x3-in strips
Cotton swabs	6515-01-464-0432*	100
Snake bite kit	6545-01-281-1237	1
Insect repellent	6840-01-003-9589*	1 oz
Insect repellent (controlled release over 24-hr period)	6840-01-463-5455*	4 oz
Insect repellent, aerosol	6840-01-278-1336	12 6-oz cans
Insect repellent (for wash treatment of BDUs)	6840-01-345-0237	12 kits
Insect sting kill swabs	6510-01-045-3506*	10
Fly bait insecticide	6840-01-183-7244	5-lb can
Dust mask	4240-01-463-5449*	20
Sunscreen	6505-01-121-2336	4-oz bottle
Sunglasses	8465-00-045-4651	1 pair
Talcum powder	8510-00-817-0295	9-oz can
Foot powder	6505-01-008-3054	45 gram container
Toothbrush, 6-in	8530-01-293-1387	12
Toothpaste, fluoride	8520-01-303-4037	12 3-oz tubes
Disposable wipes, pre-moistened, antibacterial	7930-01-423-1120	60 sheets in pop-up container
Disposable wipes, pre-moistened	8520-01-415-2929	255 individually packaged wipes
Hand cleaner, pumice	8520-00-634-1594	3-lb container
Ear plugs, disposable foam	6515-00-137-6345	200 pairs
Goggles, safety	4240-00-052-3776	1 pair
Sewing kit	8315-01-222-0680	1
Batteries, D-cell	6135-01-446-8310*	4
Batteries, C-cell	6135-01-446-8307*	4
Batteries, AA-cell	6135-01-447-0950*	4
Batteries, AAA-cell	6135-01-446-8308*	4
Batteries, 9-volt	6135-01-447-0949*	2

\*Order on a DD Form 1348-6 and put "NSN not on AMDF" in the REMARKS block.

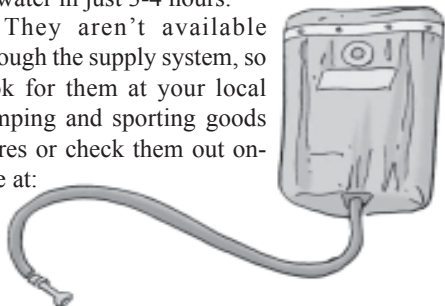


## A Good, Hot Shower

Staying clean in the desert isn't easy and taking a cold sponge bath is no one's idea of a good time. That's when a solar shower comes in handy.

These gravity-fed showers are made of solar-absorbing materials that can heat 4-5 gallons of water in just 3-4 hours.

They aren't available through the supply system, so look for them at your local camping and sporting goods stores or check them out on-line at:



<http://www.altrec.com/shop/detail/1884>

<http://www.ballystore.com/product/index.jsp?productId=502809>

<http://www.kmart.com/product/index.jsp?productId=502809>

<http://www.gijoes.com/product/index.jsp?productId=502809>

You can find other vendors by doing a web search for "solar shower".

## Keep the Sand Out

SINCE SAND HAS A HABIT OF GETTING INTO PRETTY MUCH EVERYTHING, KEEP A GOOD SUPPLY OF ZIP-SEAL BAGS ON HAND FOR SMALL PARTS AND OTHER ITEMS.



Size	NSN 8105-00-837-	Qty
4x4-in	7753	1,000
6x6-in	7754	1,000
8x8-in	7755	1,000
11x10 1/2-in	7756	500
12x12-in	7757	500

Bare Hands, HOT METAL Don't Mix



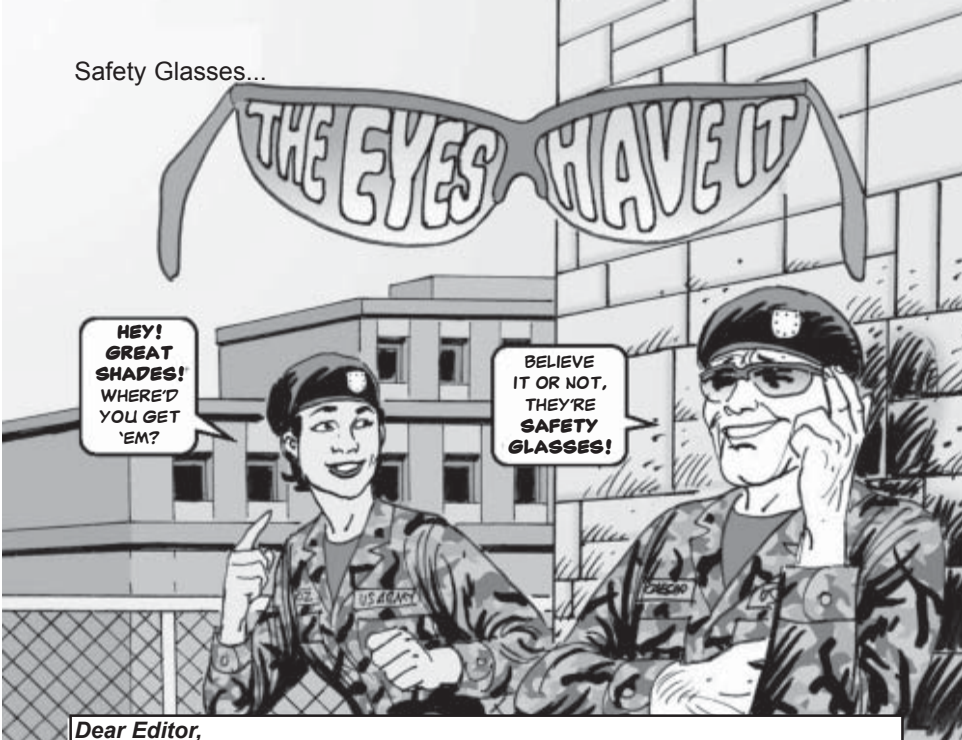
HEAVY DUTY WORK GLOVE

SIZE	NSN 8415-00-268-
1	7871
2	7872
3	7869
4	7870
5	7868

ANTI-CONTACT GLOVE

SIZE	NSN 8415-00-227-
S	1220
M	1221
L	1222

Safety Glasses...



Dear Editor,

Safety glasses are vital for mechanics and operators who need protection from small debris and sand when working at NTC or other desert environments.

Unfortunately, most safety glasses don't provide any sun protection and are so ugly that most guys won't wear them.

I found the perfect solution when I came across some safety glasses that were recently added to the supply system. These glasses filter out 99% of all harmful UV light, have curved lenses to provide 180° of protection, and have adjustable temple pieces with four different size settings.

An additional plus is the cool frame and lens style.

Frame Color	Lens Color	NSN 4240-01-500-
Camouflage	Mirror	6116
Camouflage	Amber	6161
Camouflage	Grey	6164
Camouflage	Clear	6167
Black	Mirror	6169
Black	Amber	6171
Black	Grey	6173
Black	Clear	6174
Metallic blue	Mirror	6178

SPC George B. Walsh  
TNARNG  
Athens, TN

From the Desk of the Editor:

The better they look, the more likely they are to be worn. Thanks for the info!

# COVER YOUR EYES

WHEN YOU NEED  
HEAVY-DUTY  
EYE PROTECTION,  
YOU HAVE THREE  
CHOICES...

1. Ballistic/laser protective spectacles (BLPS) for soldiers who need corrective lenses.
2. Special protective eyewear, cylindrical system (SPECS) for soldiers who don't need corrective lenses.
3. Sun, wind and dust goggles (SWDG) for protection from the elements.

All protective lenses for BLPS, SPECS, and SWDGs provide ballistic fragment protection and are available in clear, neutral gray tint (for sun protection) and laser protective configurations. Here's what's available:

BLPS	
NSN 8465-01-	Item
416-4636	BLPS, clear
417-4004	BLPS, gray
416-3207	BLPS, 2-wavelength laser protection
416-3210	BLPS, 3-wavelength laser protection
417-9963	Carrying case
416-4637	Retainer strap

application. While the prescription lens carrier can be adapted for use in the mask, it's best for operational readiness to keep two separate prescription lens carriers—one for the BLPS and one for the M40A1 mask.

You must obtain BLPS corrective lenses through your post clinic. BLPS lenses can also be used with the M40A1 mask, but you will need prescription lens carrier, NSN 6540-01-264-1348, and adapter, NSN 4240-01-389-7152, from the clinic for this

IF YOUR  
VISION IS  
20/20, TRY  
SPECS EYE  
PROTECTION...



SPECS		
NSN 8465-01-416-	Item	Size
4626	SPECS kit	Regular
4629	SPECS kit	Large
4630	SPECS, gray	Regular
4633	SPECS, gray	Large
4635	SPECS, 3-wavelength laser protection	Regular
8516	SPECS, 3-wavelength laser protection	Large
4628	SPECS, clear	Regular
4631	SPECS, clear	Large
4634	SPECS, 2-wavelength laser protection	Regular
4632	SPECS, 2-wavelength laser protection	Large
4627	SPECS case	—
4637	Retainer strap	—

The SPECS kits each contains a clear ballistic protective lens in a frame, an extra neutral gray ballistic fragment protective lens, a retaining strap, carrying case, and extra temple pieces.

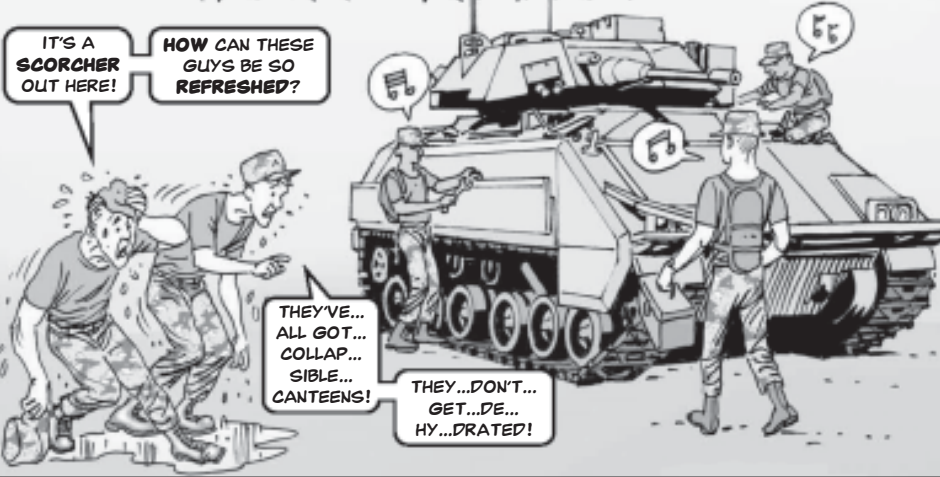
SWDG	
NSN 8465-01-	Item
109-3997	Lens, Class 3, clear
109-3996	Lens, Class 4, neutral
439-3506	Goggle assembly, Class 5, green, 2-wavelength laser protection
439-3511	Goggle assembly, Class 6, brown, 3-wavelength laser protection
328-8268	Kit (clear goggle assembly with an extra neutral gray lens)

The SWDG kit includes a synthetic rubber frame; clear and gray, class 3 and 4 plastic lenses; and a carrying case.



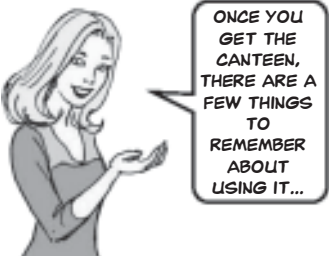
Collapsible Canteen Carrier...

# HEAT RELIEF



Working around a motor pool on a hot summer afternoon can drain your strength. Metal and concrete reflect the heat and make a hot day dangerously hotter. But you've got to be out in that heat if you're going to do PMCS.

So protect yourself from dehydration or heat stroke by wearing a collapsible canteen carrier. A 2-qt collapsible canteen, NSN 8465-01-118-8173, with carrier, NSN 8465-00-927-7485, and optional sling, NSN 8465-00-269-0682, costs less than \$19 total and is authorized by CTA 50-900. A 100-oz collapsible hydration system (MOLLE hydration bag with drink tube and carrier), NSN 8465-01-465-2154, is authorized by CTA 50-900, easily worn on your back and costs \$32.70. A 5-qt canteen without drink tube, NSN 8465-01-254-5759, is authorized by CTA 50-970, and can also be attached with tie cords and worn on your back. Get your commander's approval before ordering.



- Don't put soft drinks or drink mixes in the canteen. They leave a smell that's hard to get rid of. Put only water in the canteen.
- Keep the bladder part of the canteen away from intense heat that can melt it.
- The inside of the 2-qt carrier has a fabric that will help the canteen stay cooler in hot weather if you soak the fabric with water. In the winter, the fabric will help insulate the canteen if the fabric is kept dry.

Water Tanks...

# FILL-LINE REMINDER



You'll end up with wet boots and a busted 3,000-gal onion tank, GTA-Z60 TPW, NSN 5430-01-469-8744, if you follow the info on Page 0002 00-2 of TM 10-5430-237-12&P.

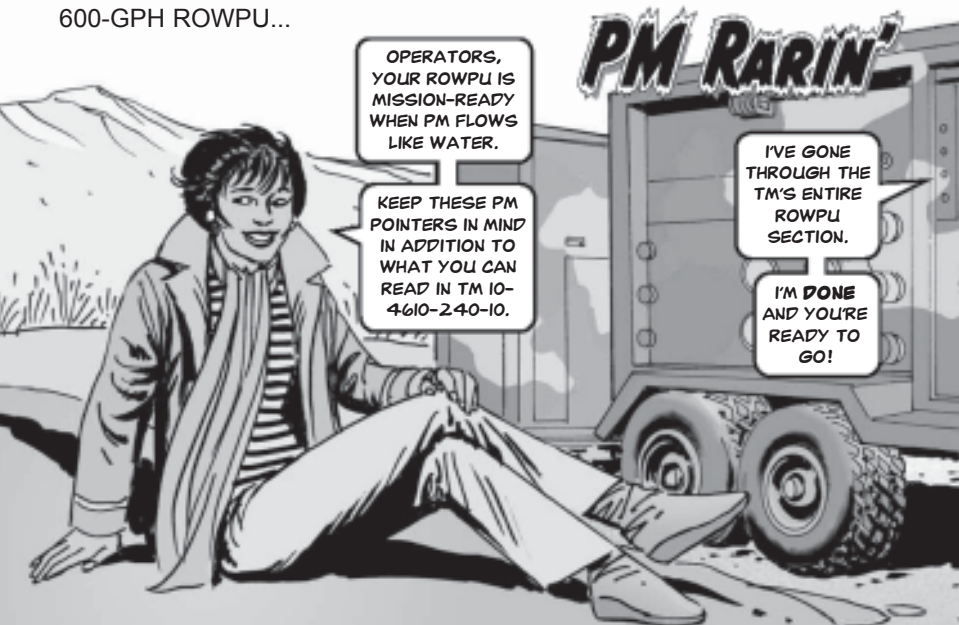
That's because the water fill level says 45 inches. That's wrong—it should be 32 inches!

Filling the onion tank to 45 inches is almost the equivalent of 5,000 gallons of water. The tank will rupture and break at that level. It's only designed to hold 3,000 gallons of water.

Play it safe with no more guesswork. Use a yardstick to mark a line at 32 inches around the tank with a permanent marker. In the meantime, make a note of the error until there's a change or revision to the technical manual.

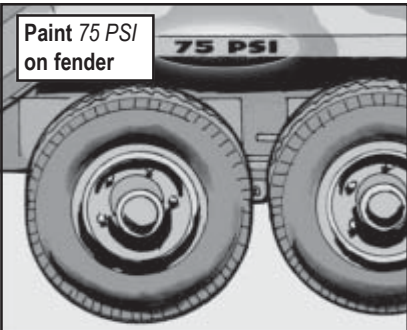
Mark a 32" fill line around onion tank





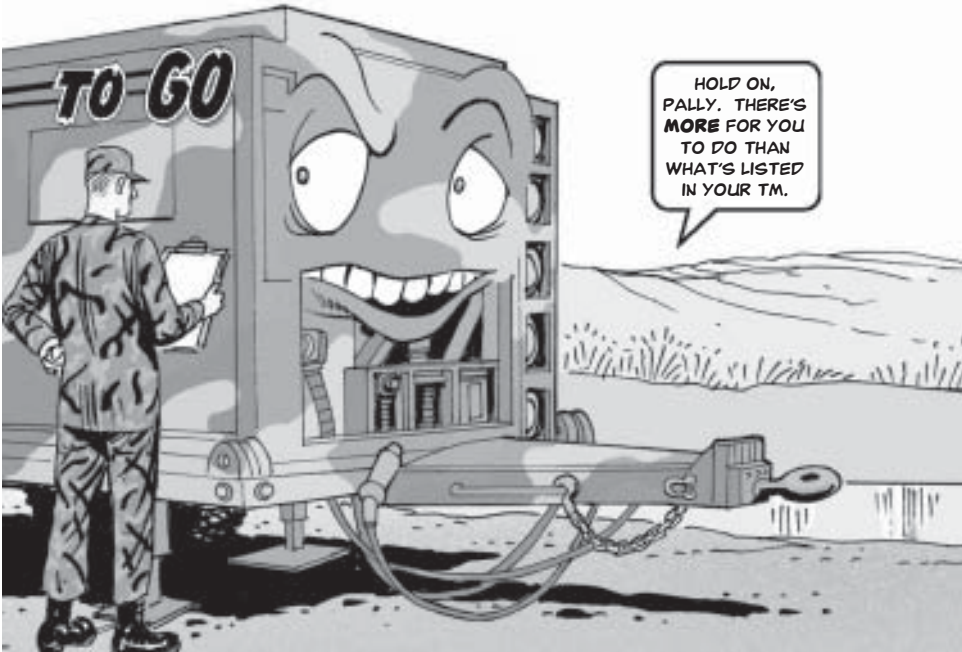
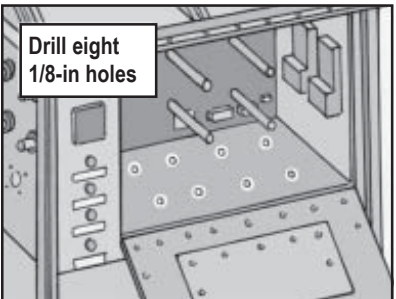
**Tire PSI**

Keep the tires on your ROWPU at 75 psi at all times. Don't lower the pressure for off-road use. That puts a lot of stress on the sidewalls and can lead to a blow-out. As a kindly reminder, have your mechanic paint "75 PSI" on the fender above the wheels.



**Junction Box Drain**

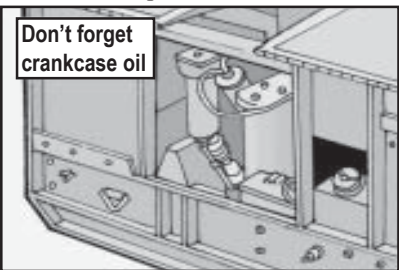
Rain and high-pressure water pools inside the junction box. The water corrodes switches, relays and wiring. Since you can't stop the water from getting in, give it somewhere to go. Have your mechanic remove the box and drill 1/8-in holes in the bottom of the box.



**Generator Oil Level**

When you pull PMCS on the ROWPU, don't forget about the 30-KW generator. If the generator doesn't run, neither does your ROWPU. The generator is covered by the Army oil analysis program (AOAP). Sample the crankcase oil like it says in the LO, and send the sample to the AOAP lab.

If a lab isn't available, have your mechanic drain and refill the crankcase oil and change the filter by the LO. After an oil change, run the engine for five minutes and check for leaks. After shutdown, check the crankcase oil level and make sure it's at the FULL mark. Do not overfill the crankcase because too much oil will blow seals.



FOR COMPLETE GENERATOR PM, READ TM 5-6115-465-12 AND LO 5-6115-465-12.



# Transport and

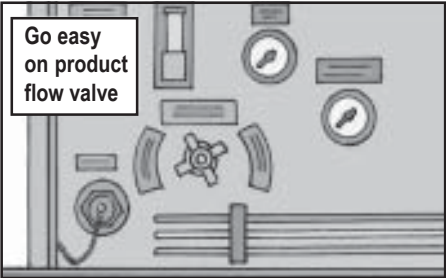


A ROWPU operator with a long face and rampant mood swings can only mean one thing: his water purification unit isn't working, or it's pumping out swamp water!

Preparing the ROWPU for transport and some good PM will get rid of the long face and keep your ROWPU mission-ready.

## Travel Know-how

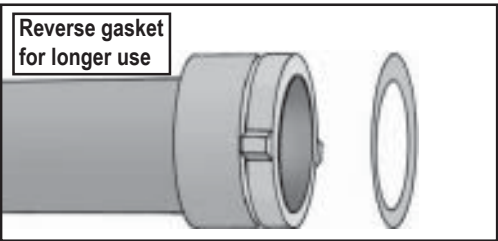
During travel, the product flow valve should be in the open, not closed, position. Also, it shouldn't be tightened. Tightening it in either position could damage the valve, because it could corrode in place. Then it takes excessive force to move the valve. The threads could be damaged or the valve stem broken off.



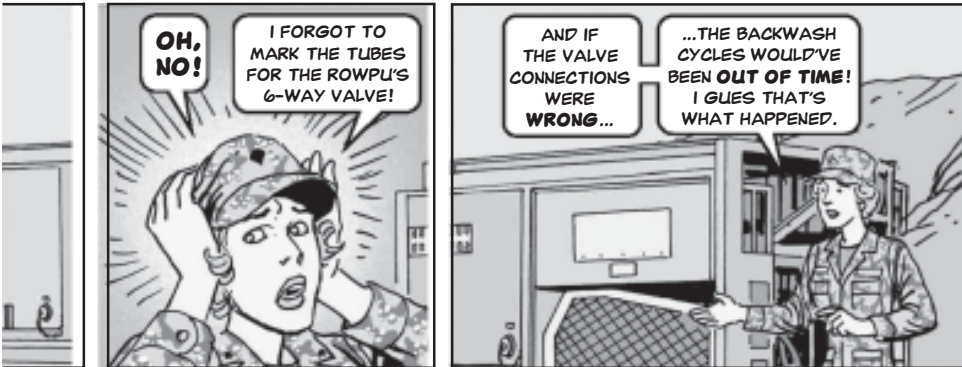
## Get Rid of Groove

If the ROWPU's water suction hoses are quickly getting a "set" or groove in the gaskets, they're too tight. So tighten 'em just enough to hold a seal.

Reverse the gaskets between uses to help keep the seals from getting grooved.

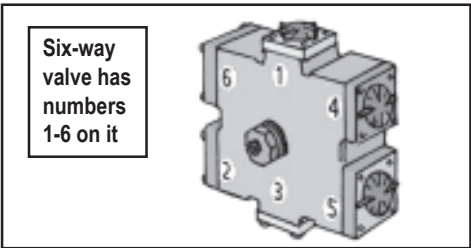


# PM Tips



## 6-Way Valves

The 6-way valves are molded with numbers on them. When you take apart the valve, make sure you look at the numbers and mark the tubes with the same number as the 6-way valve connection. If you don't, you'll put your valve back together wrong.



## Timer Reminder

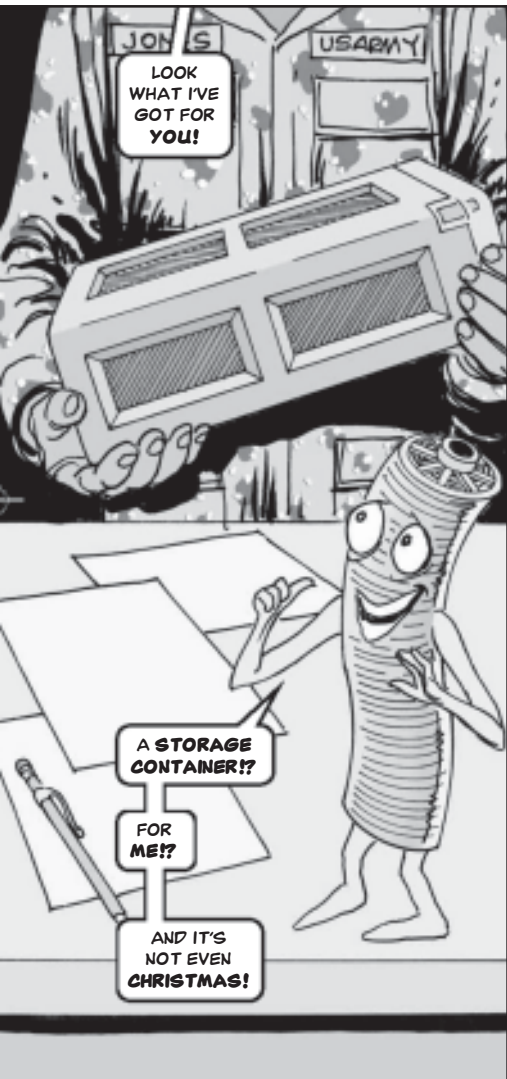
The timer has six tubes connected to it from the 6-way valve and two from the multimedia backwash piping. Mark these in the same manner. If the timer or the valve connections are wrong, the backwash cycles will be out of time. Then you can't backwash the multimedia filter, and your mission goes down the drain!

In fact, always tag, mark or identify every wire, hose, tube or line so that you can put your ROWPU back together the same way you took it apart.

Never bypass or override the timer during operations. The backwash cycle on the ROWPU cannot be controlled manually, and bypassing the timer could damage it. Worse yet, it's dangerous! If you touch the capacitor or any other "hot" part of the electrical timer, you could be seriously injured.

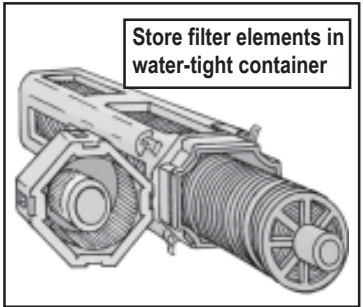
Remember, always allow the backwash cycle to complete itself naturally once it begins. Reset the switches before backwashing only if the timer is not function-

# Filter Element Storage



Those 6-in diameter filter elements on the reverse osmosis water purification unit have a shortened life span if they're left lying on the vehicle exposed to the weather.

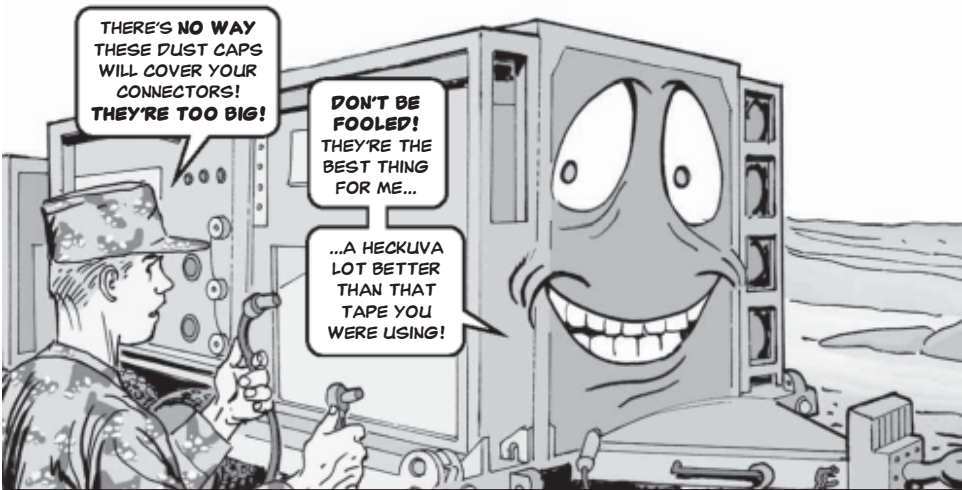
To increase the life of the elements, take them out during extended periods between operations and store them in water-tight containers.



Order the reverse osmosis (RO) element reusable container assembly with NSN 4610-01-212-2704. That NSN brings you eight containers. Each container will hold one 6-in RO element and will retain the moisture that is in the element. It so happens that eight is exactly the number of containers for one 600-GPH ROWPU.

The desert sand-colored containers are lightweight and can be stacked four high and banded together. Store 'em in garrison or on the ROWPU.

# USE THE DUST CAPS



It's plain and simple...dust caps aren't much good if you don't use 'em.

Keep that in mind when you disconnect the chemical feed lines from the cans on your 600-GPH reverse osmosis water purification unit (ROWPU).

If you leave those lines uncovered, dust and dirt and anything gritty will get inside the chemical connectors.

Don't be fooled by the dust caps when you're ready to use 'em. They may seem too large to fit snugly over the connectors. But give 'em a try. They'll snap right in place over the groove on the connectors. Order the caps with NSN 5430-01-307-5989, 5430-01-307-2679, or 5430-01-307-4394. (Make note that these NSNs will be added to TM 10-4610-215-10 and to the -24P.) You may have to try all three NSNs to find the right cap for your connector.

By the way, tape is no substitute for a missing connector cap. It leaves behind a sticky residue that attracts even more dust and dirt.



# Use, Repair and Disposal



YOU CAN'T TELL MUCH ABOUT THE CONDITION OF COLLAPSIBLE FUEL OR WATER TANKS UNLESS YOU INSPECT THEM.

IN FACT, A VISUAL INSPECTION IS THE ONLY WAY TO BE SURE THAT A FUEL OR WATER TANK IS READY FOR DEPLOYMENT AND USE.

BEFORE YOU INSPECT, THOUGH, CHECK THE SHELF AND SERVICE LIFE OF THE TANKS.

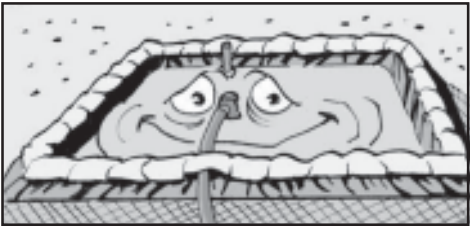


## Shelf, Service Life

Fuel tanks from 3,000 to 210,000 gallons have a dry, indoor shelf life of 12 years. Fuel tanks not stored dry and indoors have a 5-year shelf life from date of receipt, or 12 years from the manufacturing date, whichever comes first.

Once fuel is put in a tank for the first time, the tank is good for 3 years max. Service life may be less than 3 years, depending on where and how often the tank is used.

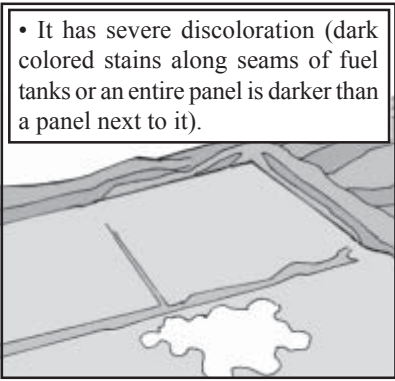
Water tanks from 160 to 50,000 gallons have no shelf or service life restrictions. So use them until they are no longer repairable.



## Inspection Criteria

Dispose of a tank if:

- It has holes, tears or cuts through the coated fabric greater than 6 inches long.



- It has seams that show signs of coming apart.



- It has cracks in the exterior coating.

- It has fungus growth.



Repair a tank if:

- It has holes, tears or cuts through the coated fabric that are less than 6 inches long. Make temporary repairs using the tank's mechanical repair kit. Permanent repairs can be made with an adhesive repair kit, NSN 5430-01-359-1078 (for both fuel and water tanks).



- It has abrasions that have exposed the nylon fabric underneath the outer coating. Re-coat with the adhesive repair kits listed above.

- It has blisters, which are areas where the coating appears to have separated from the fabric or where fluid has leaked between tank layers.



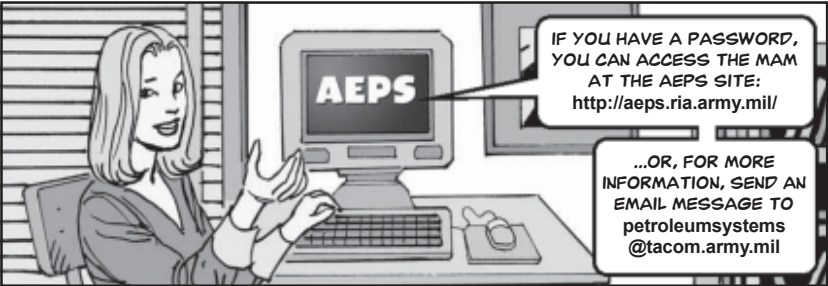
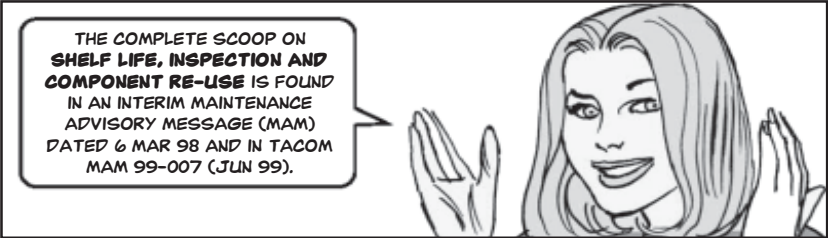
Fix this damage by puncturing and cutting away the separated coating. Temporarily repair the defect with the mechanical repair kit. Make permanent repairs with the adhesive kits listed above.

Re-use of Components



Once a tank’s service or shelf life is used up, serviceable components should be removed for re-use before you get rid of the tank.

These items include berm liners, filter/discharge hose assemblies, drain hoses and control valves, gate valves and some other vent and hose assemblies.



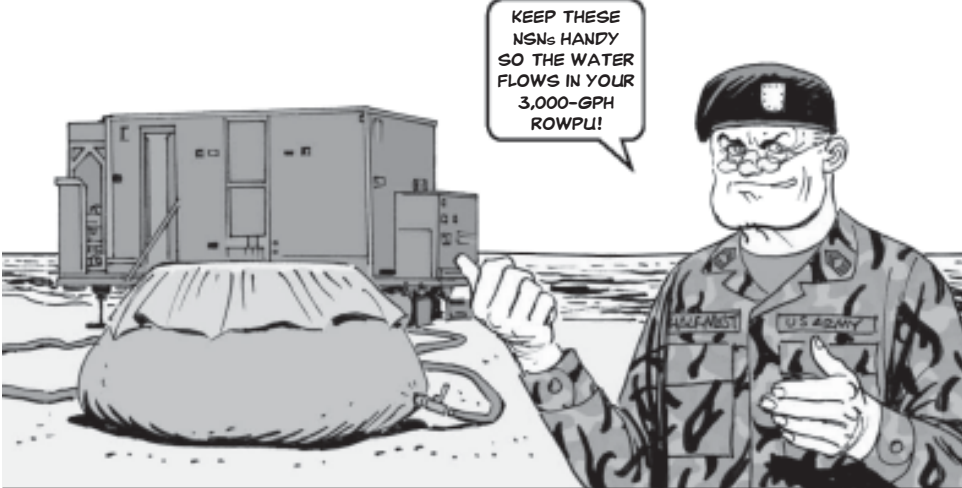
3,000-GPH Trailer-mounted ROWPU...

Hard To Find Repair Parts

Trying to find repair parts for the 3,000 GPH trailer-mounted ROWPU can be a real puzzler. That’s because some of these old parts are no longer available or the parts info in the TM has changed.

Make a note of these changes in TM 10-4610-232-24P until there’s a change or revision to the technical manual.

Item	Figure	NSN	Name
41	3	5340-01-468-4943	Plate, mounting
2	43	2540-01-468-5020	Latch, electrical panel door
96	67	5330-01-467-1605	Gasket, retainer in booster pump discharge assembly
13	69	4730-01-467-1526	Clamp, product water out
1	72	5340-01-468-4937	Clamp, basket retainer
4	80	4810-01-467-1589	Valve, solenoid assembly
4	81	4810-01-467-1591	Valve, solenoid assembly
17	83	5999-01-467-1685	Level switch
18	83	5999-01-467-1676	Level switch
19	83	5999-01-467-1683	Level switch
9	84	4730-01-467-1501	Clamp, multi-media tank
4	116	4730-01-468-5339	Elbow, waste out (AquaChem models only)
33	BULK	5330-01-468-5373	Material, electrical panel seal



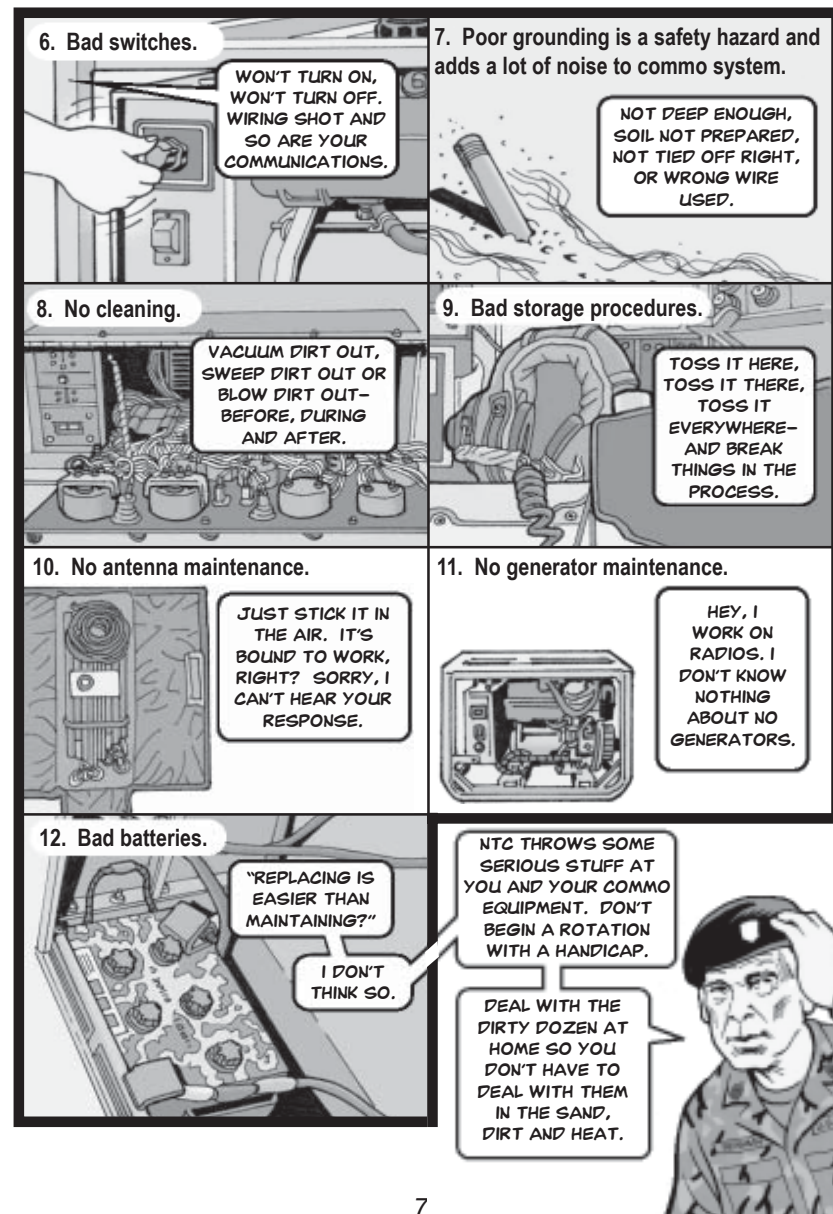
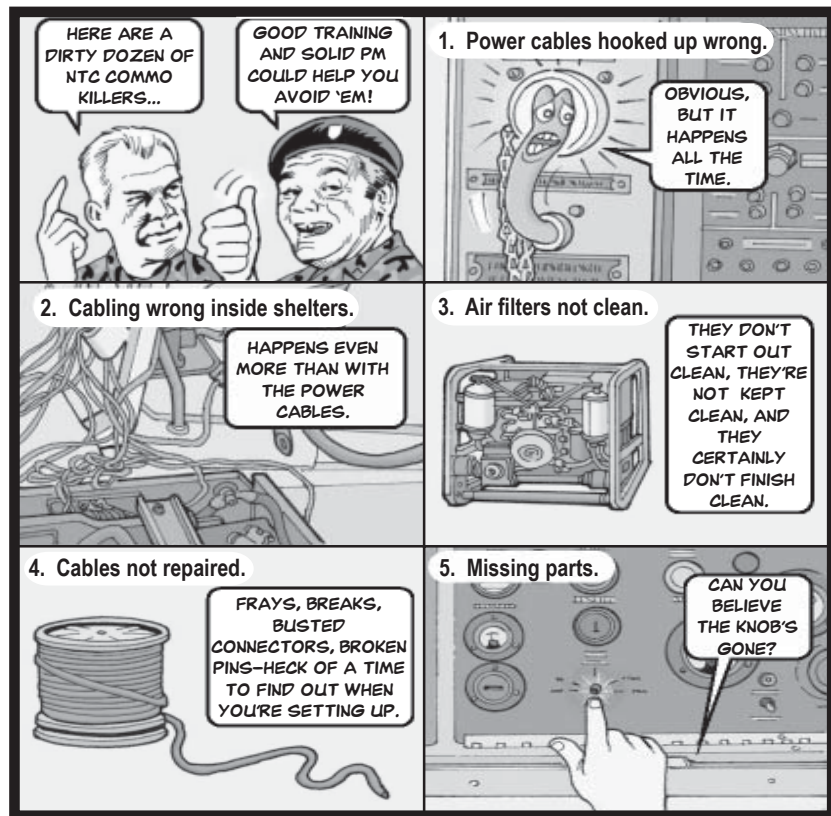
# Commo & Electronics

National Training Center...

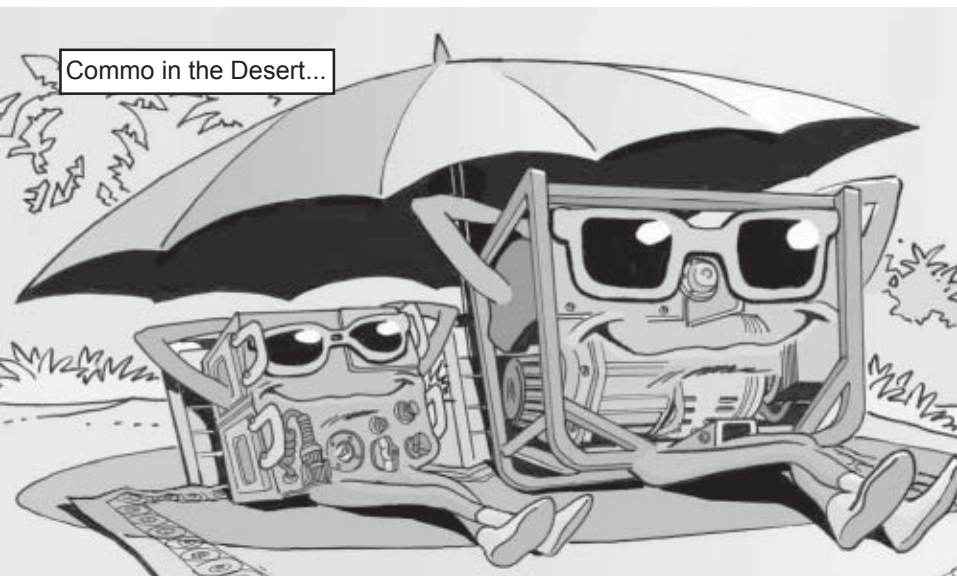
## What To Know About COMMO

Pulling a rotation at NTC can be rough on commo equipment, but pulling one without first pulling PM can be a real bear.

People in the know say that 50 percent of the communication equipment problems at NTC can be avoided if proper PMCS and training takes place at home before your commo act hits the road.



Commo in the Desert...



### Good Moisture

IN THE DESERT-  
NTC OR ELSEWHERE-  
MAINTENANCE OF RADIO  
SETS AND OTHER  
ELECTRONIC EQUIPMENT  
IS TOUGH. IT'S EASY  
FOR SAND AND HEAT TO  
DAMAGE EQUIPMENT.

HERE ARE A  
FEW DESERT  
MAINTENANCE  
TIPS.

Put damp rags on the tops of radios to keep them cool. Make sure the rags are damp, not soaking wet. Soggy rags lead to water inside the radio. Some of you have tried letting ice melt on top of a set. Don't. That much water assures some will get inside and do damage.

Cool radio down  
with damp rags



HOLD IT!  
BEFORE YOU  
DO THIS,  
READ ON...



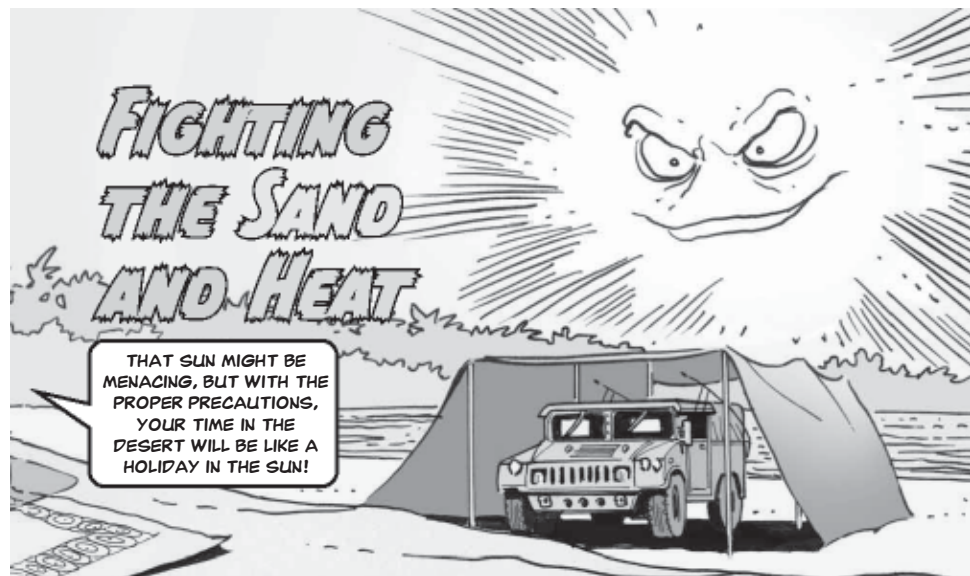
Before you put on the damp rag, make sure all screws are screwed down tight and all seals are in good condition.

Check  
screws and  
seals before  
adding  
damp rags



## FIGHTING THE SAND AND HEAT

THAT SUN MIGHT BE  
MENACING, BUT WITH THE  
PROPER PRECAUTIONS,  
YOUR TIME IN THE  
DESERT WILL BE LIKE A  
HOLIDAY IN THE SUN!

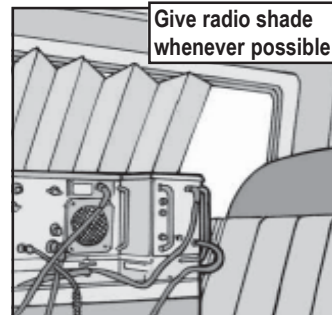


Of course, whenever possible, shade your radio. Use cardboard or your vehicle's canvas top. Anything will help that keeps the glaring sun off the radio, but doesn't hold in the heat.

A fan will run itself to death trying to cool your radio in the desert.

Give the radio the moisture and shade treatment to help the fan.

Give radio shade  
whenever possible

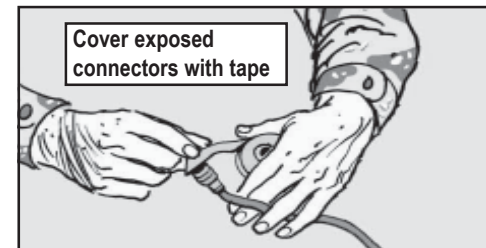


### Bad Moisture

Overnight, condensation forms on metal surfaces that are cooler than the air temperature.

This condensation can affect electrical plugs, jacks and connectors. If condensation is affecting your commo connectors, tape over all connectors that may be exposed to moisture overnight. This prevents that moisture from contaminating the contacts.

Cover exposed  
connectors with tape

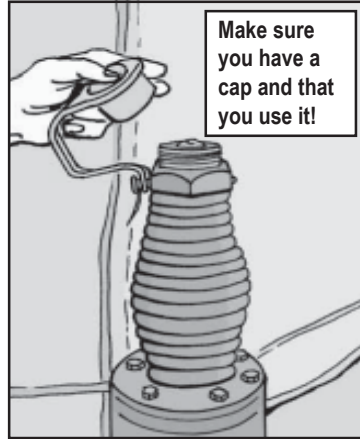
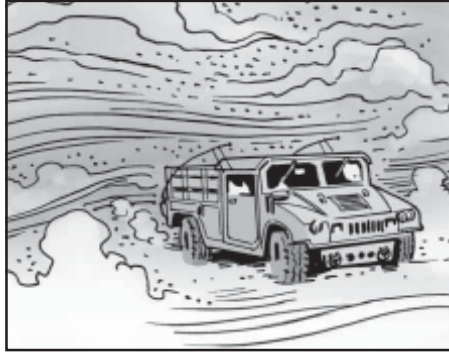


Plugs should be dried before inserting them into equipment jacks. Excessive moisture or dew should be removed from antenna connectors to prevent arcing.

## No Moisture

Static electricity is common in the desert. It's caused by wind-blown sand and extremely low humidity. Poor grounding conditions aggravate the problem. Make sure your equipment is properly grounded.

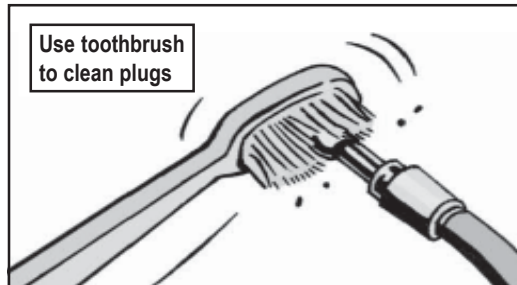
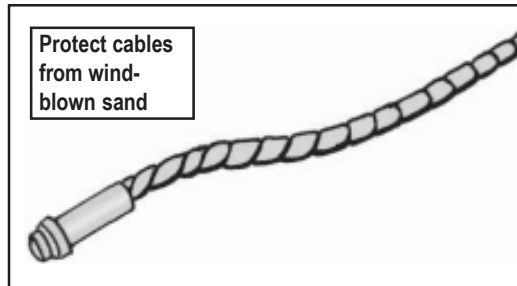
Be sure to use tip caps on all antennas to cut down on wind-caused static discharges.



## Electrical Insulation

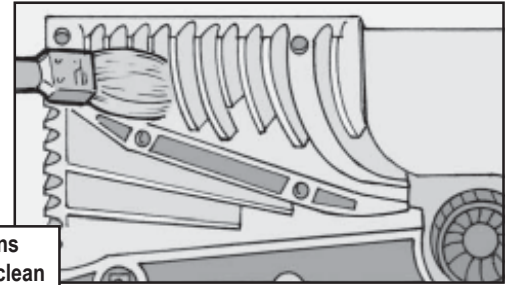
Wind-blown sand and grit will damage electrical wire insulation over a period of time. All exposed cables should be protected with tape or large shrink-wrap tubing before insulation becomes worn. Of course, keep dust caps on all cable connectors when not in use.

Sand will also find its way into parts of items such as spaghetti cord plugs, either preventing electrical contact or making it impossible to join the plugs together. Carry an old toothbrush and use it to clean plugs before they are joined.



## A Little More Cleaning

Keep all cooling fans clean and their vents clear of all clogging sand, dust and dirt. Use a brush or compressed air—whatever your equipment TM says—to clean the fan and the areas around it.



## Some Things to Check

If you have any broken or missing knobs, switches or connectors, get them replaced.

Dirt and sand work into the connectors and keep the contacts from touching. If they're dirty or making bad contact, clean them with low-pressure air or a soft brush.

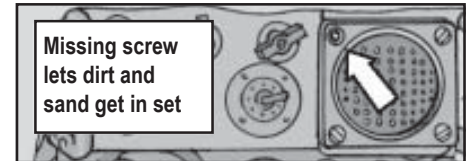
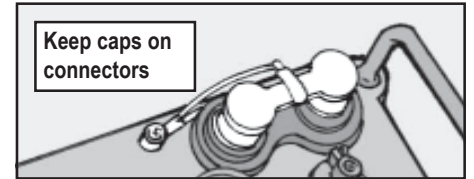
Keep connector caps on audio connectors to keep out dirt and sand when the radio's not in use.

If you have loose or missing panel or cover screws, tighten or replace them. A missing screw lets dirt and sand get inside your set.

Give your commo equipment room to breathe. If you pile gear on or around it, heat quickly builds up. Keep field gear, maps, manuals and other items away from the RT blower fan. Blocking the airflow will cause the heat to build up inside your set.

Make sure loose latches and mounts are tightened properly or repaired. They can cause commo equipment to bounce out on a rough desert ride.

Check the whip antenna's mast base to be sure the contact is clean. Use low pressure air or a soft brush to clean it.



AN/GRC-103 Radio...

# BE A DUST BUSTER



Sometimes something real small can cause really big headaches. Dust is tiny, but it packs a big, damaging punch like when it clogs the transmitter's air filter on the AN/GRC-103 radio.

Dust clogging the air filter makes the ventilation fan work harder and harder to suck in cooling air. The transmitter overheats and the OVERHEAT lamp comes on and stays on. The transmission signal degrades or the signal goes out altogether.

That's just the beginning of the problems. Components begin to burn up—like driver tubes, the RF amplifier, frequency generating circuits and the transmitting section of the duplexer.

Overheat lamp on? Inspect air filter!

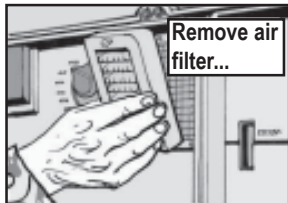


ALL THIS IS NOT GOOD AND ALL THIS IS AVOIDABLE.

Look at the filter before and during operations to make sure it's clean and stays that way. If you're in a dusty environment, make your checks more frequent.

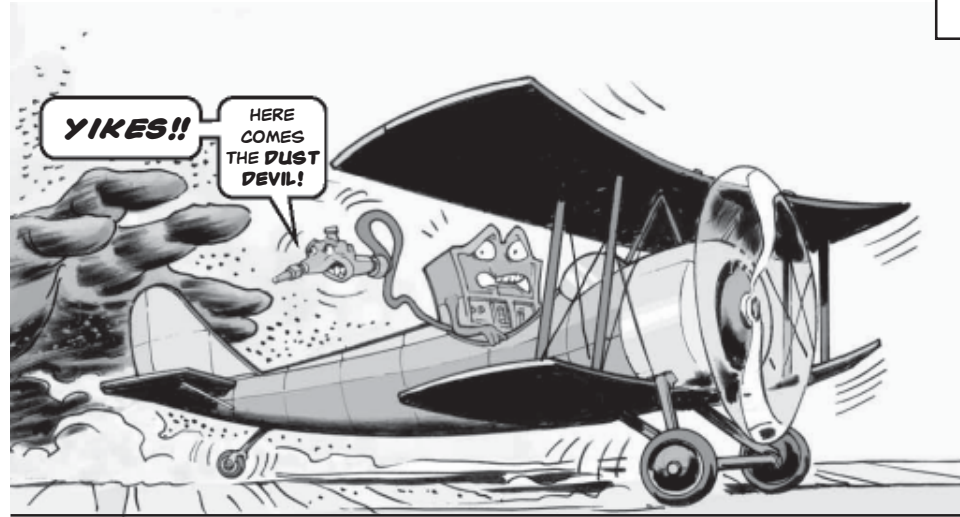
If the filter is dusty, remove it from the transmitter by loosening the captive screws. Use an air hose and air gun to blow dust out of the filter. Direct the airflow from the inside of the filter to the outside.

Remove air filter...



YIKES!!

HERE COMES THE DUST DEVIL!

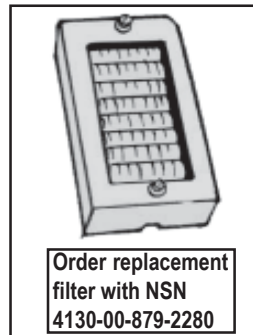


Don't use the air hose unless you have an air gun, NSN 4940-00-333-5541, to attach to it. The air gun limits the outlet pressure to 30 psi, a safe level that won't damage the filter or injure you.

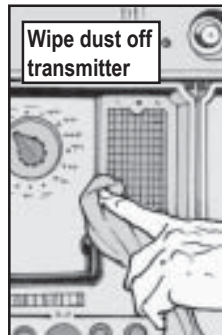


...and blow out dust

If you don't have an air hose and air gun, tap the filter and shake the dust out. If your mission permits, wash the filter in warm water and a mild detergent, NSN 7930-00-929-1221. Let it air dry for a few hours before reinstalling it.



Order replacement filter with NSN 4130-00-879-2280



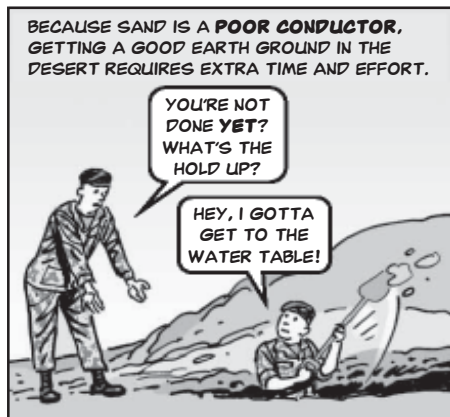
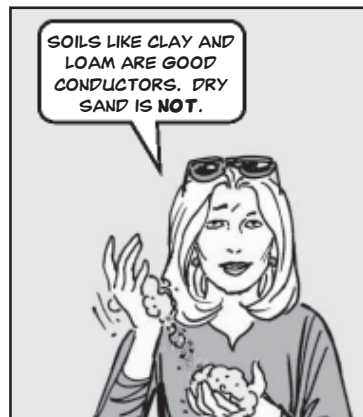
Wipe dust off transmitter

Dust also collects on the recessed area and the metal screen where the filter fits on the transmitter. Use a cloth to wipe them clean.

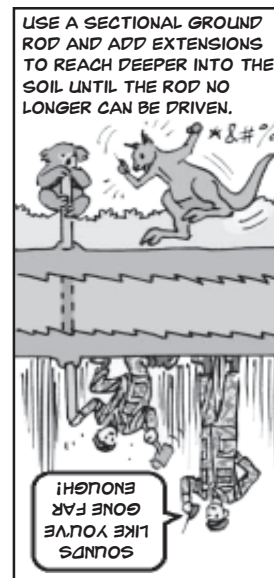
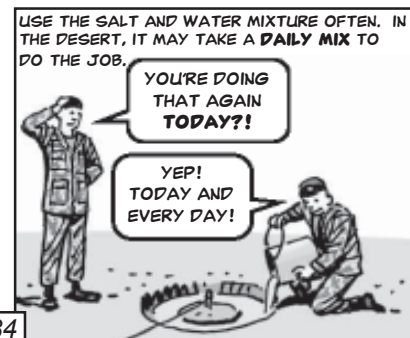
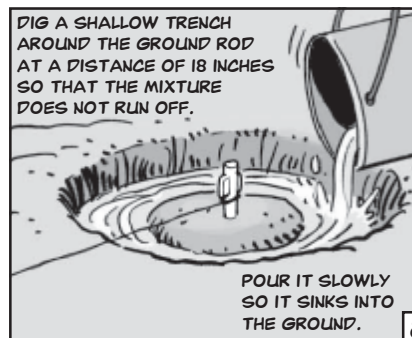
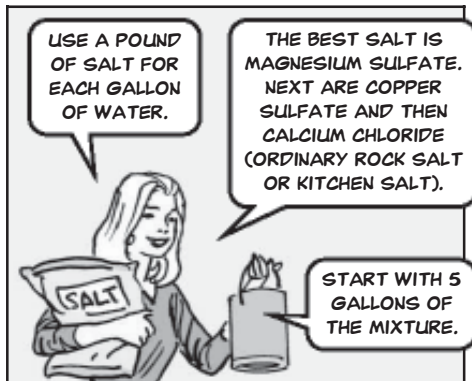


ALSO WIPE DOWN THE TRANSMITTER FREQUENTLY TO KEEP DUST AWAY FROM THE VENTILATION FAN.

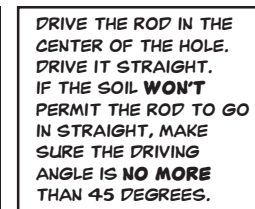
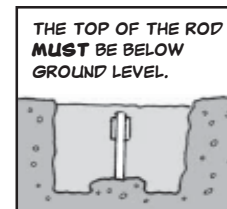
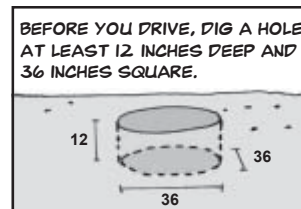
# GROUNDING IN THE DESERT



## Prepare the Soil



## Before You Drive



LEAVE ABOUT 3 INCHES OF THE ROD SECTION ABOVE THE THE RIM OF THE HOLE. WHEN ADDING ROD EXTENSIONS MAKE SURE EACH SECTION IS TIGHTLY CONNECTED TO THE PREVIOUS ONE.

IF THEY'RE **NOT** TIGHT, WHEN YOU DRIVE IN THE ROD, YOU'LL **DAMAGE** THE COUPLING SLEEVE THREADS.

**DON'T** HIT THE THREADED END OF THE ROD WITH THE HAMMER. THIS WILL **DAMAGE** THE THREADS, TOO.

DON'T DAMAGE MY THREADS, MAN!

USE A DRIVING BOLT ON THE TOP SECTION AND MAKE SURE IT'S TIGHT. A LOOSE BOLT WILL BREAK OFF.

IF POSSIBLE, USE A **DRIVING HAMMER** WHEN INSTALLING A SECTIONED GROUND ROD.

**SLIDE HAMMER**, NSN 5120-01-013-1676, MAKES IT EASIER TO DRIVE RODS, AND EASIER TO GET THEM OUT, TOO. FOR DRIVING RODS INTO **VERY HARD** DESERT GROUND, USE A 12-LB SLEDGE HAMMER, NSN 5120-00-293-0887.

IF YOU CANNOT REACH THE WATER TABLE WITH A SINGLE GROUND ROD OR ONE WITH EXTENSIONS, USE MULTIPLE GROUNDS AND THE SALT-WATER MIXTURE.

DRIVE IN THE ADDITIONAL RODS TWO TO FOUR ROD LENGTHS APART.

IF **THREE** RODS ARE USED, DRIVE THEM IN A TRIANGULAR PATTERN.

IF **MORE THAN FOUR** RODS ARE USED, PUT THEM IN A STRAIGHT LINE OR A STAR PATTERN, WHICH WORKS WELL IN THE DESERT.

WHEN USING MULTIPLE RODS **ALWAYS** CONNECT ALL THE RODS TOGETHER, THE FINAL ROD BEING CONNECTED TO THE EQUIPMENT TO BE GROUNDED.

IF YOU CAN'T DRIVE A GROUND ROD MORE THAN 4 FEET, DIG A HOLE, ADD THE SALT-WATER MIXTURE AND THEN BURY THE ROD HORIZONTALLY ALMOST 1 1/4 FEET DEEP.

GROUND ROD ASSEMBLY, NSN 5975-00-878-3791, COMES WITH...

Rods, NSN 5975-00-878-3791

Couplings, NSN 5975-00-794-2523

No.6 AWG wire, NSN 6145-00-395-8799

Terminal lug, NSN 5940-00-271-9504

Drive/head stud, NSN 5975-00-924-9927

Clamp, NSN 5999-00-186-3912

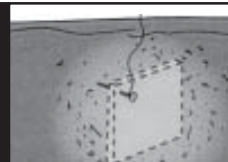
## Grounding Plates

SINCE SAND IS EASY TO MOVE, **GROUNING PLATES** CAN BE A GOOD IDEA IN THE DESERT.

THEY ALSO GIVE YOU A LARGE, METALLIC AREA THAT IS IN CONTACT WITH THE SOIL. THE GROUND PLATES—USE TWO TO FOUR—SHOULD BE SPACED AT LEAST 10 FEET APART.

TO MAKE A GROUND PLATE, START WITH A CLEAN, BARE-METAL PLATE OR SHEET 1/4 INCH THICK.

THE PLATE SHOULD HAVE AT LEAST 3 SQUARE FEET OF SURFACE CONTACT WITH THE GROUND. THE LARGER THE PLATE, THE LOWER THE RESISTANCE AND THE BETTER THE GROUND.



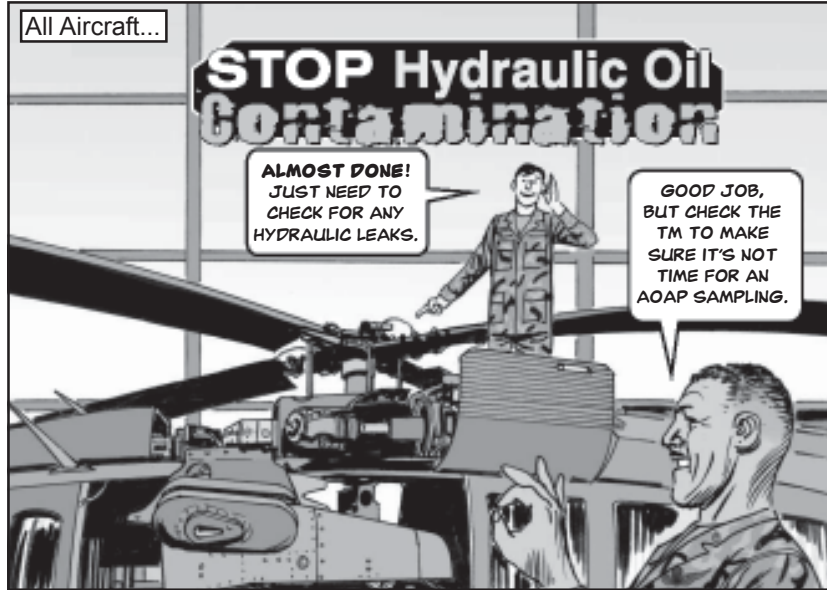
ALONG WITH THE PLATE YOU'LL NEED A **METAL BOLT, NUT AND LOCK WASHER** TO ATTACH THE GROUND WIRE.

DRILL A HOLE IN THE CENTER OF THE PLATE JUST LARGE ENOUGH FOR THE BOLT. DIG A HOLE SO THAT THE PLATE CAN BE BURIED VERTICALLY, THE TOP EDGE ABOUT 5 FEET BELOW THE SURFACE.

IT'S EASIER TO BURY THE PLATE VERTICALLY AND STILL ENSURE GOOD SOIL CONTACT ON BOTH SIDES OF THE PLATE.

POUR YOUR MIXTURE OF WATER AND SALT INTO THE SOIL AROUND THE PLATE TO FURTHER INCREASE CONDUCTIVITY.

# Aircraft



When a surgeon performs an operation, he operates with clean tools in an environment that is as free as possible of contaminants which can infect the body. Without surgery SOP, patients could get sick and die from the infection.

Likewise, mechanics, you need to treat your bird's hydraulic systems with clean tools and hydraulic oil in a clean environment. When you perform maintenance, such as adding or changing hydraulic oil or removing and installing components on your bird's hydraulic systems, keep them free of contaminants. Keep contaminants out of the process.

Before flushing hydraulic systems, inspect, service and clean the hydraulic servicing unit or hydraulic test stand to be used. That way you won't introduce outside contaminants into your hydraulic oil.



- Aircraft hydraulic fluid must be clean so hydraulic systems remain operational.
- Aircraft hydraulic systems are easily contaminated if you use leftover open cans of hydraulic oil. Always use a fresh can of approved oil per your TM. The can lid and can opener must be clean, too.
- Always use clean rags to wipe off exposed lines and openings. Use of dirty rags or tools will contaminate hydraulic systems.
- If your TM says don't mix different types of hydraulic oils, don't mix them.
- Whenever your aircraft is undergoing any type of hydraulic maintenance, it's especially important to ensure all component/line openings are capped or covered. If a new component is being installed, be sure to remove all the preservative fluid that was shipped in the part.

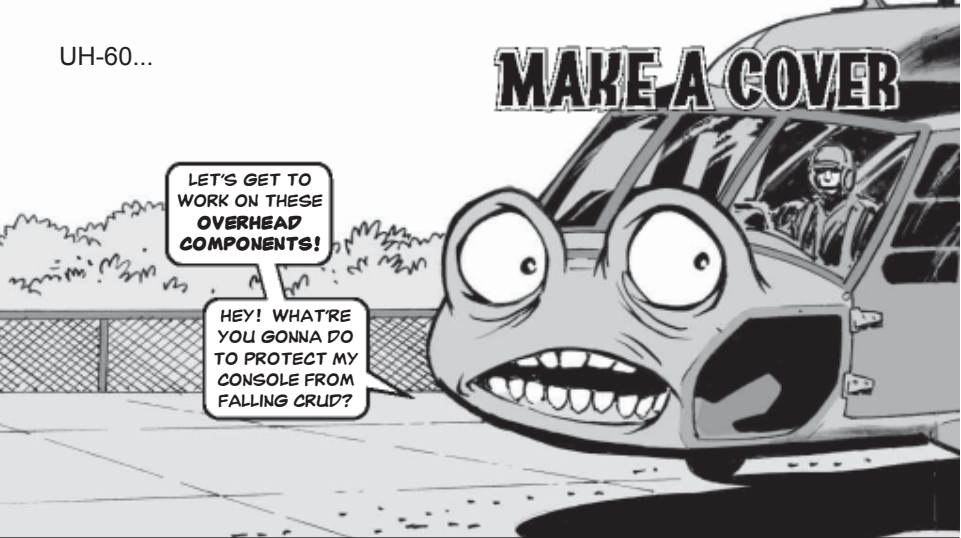


- ✓ Eyeball all hydraulic pumps and reservoir sight glasses for oil level and color.
- ✓ Check for hydraulic fluid leaks. If you find any, refer to the aircraft TM for proper corrective action now. Later might not come around.
- ✓ Eyeball indicator buttons, and if popped, change hydraulic filters. Dirty filters allow contaminants to bypass the filter and muck up the hydraulics.
- ✓ Make sure all hydraulic systems are safe from moisture, dirt, and other fluids.
- ✓ Be sure that all exposed hydraulic pistons are wiped down during preflight.

Follow your TM's hydraulic servicing and maintenance procedures exactly. Shortcuts could put you and your bird in harm's way.

Keep your bird's hydraulic system's life blood clean and it won't get sick from contaminated fluid. For example, AH-64A/D, AOAP sampling should be done every 50 hours. TB 1-1520-238-116 has the details.





Dear Rotor,  
Our air crews have problems with console knobs, switches and buttons sticking.

When working in the UH-60 cockpit on overhead components, dirt, oil, and sand drop down on the console and gum up the works.

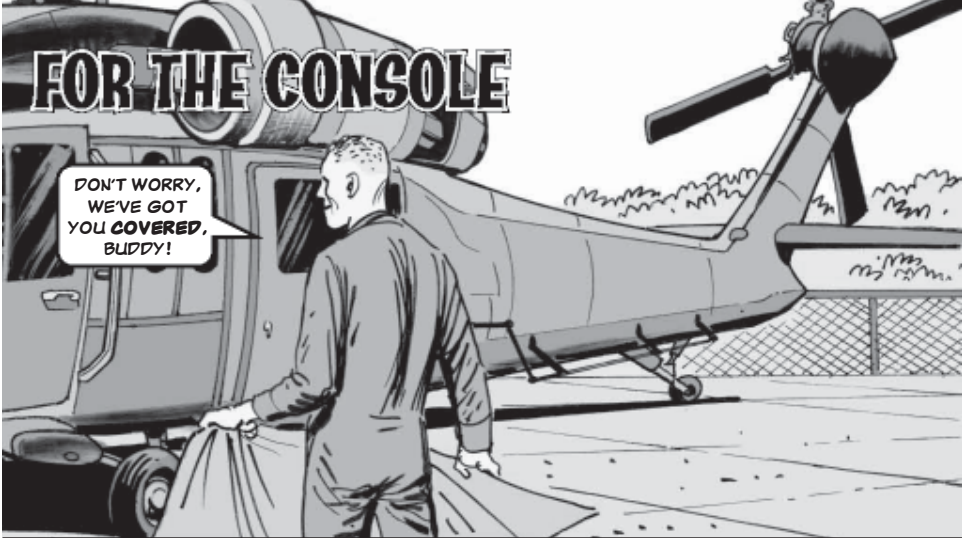
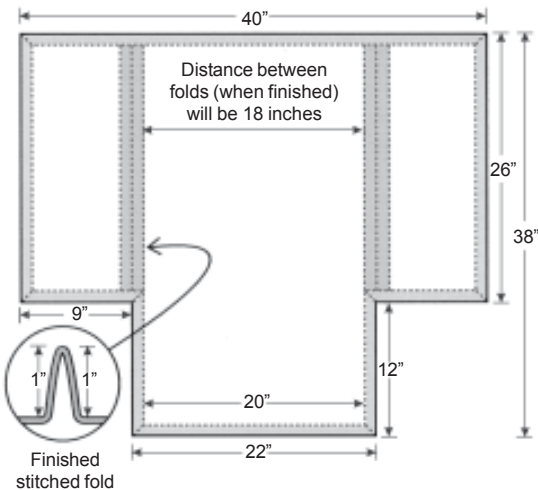
We've come up with a cover that protects the console from the falling gunk and can give some dropped-tool protection, too.

It also works well while we're performing maintenance in a sandy environment.

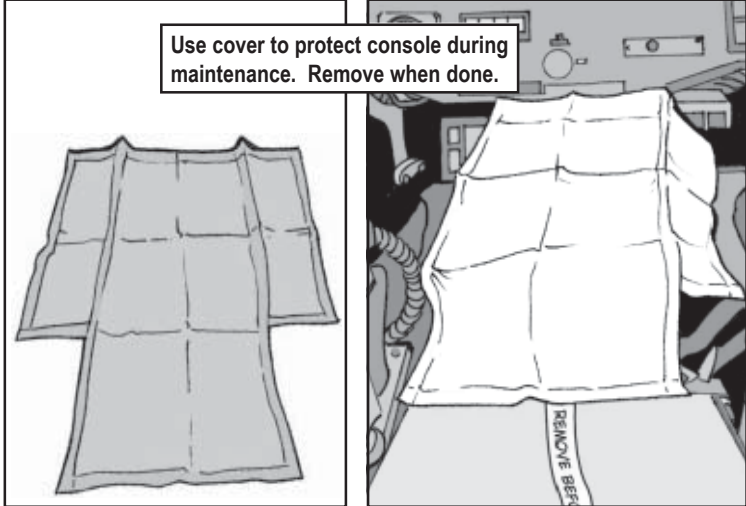
1" folds around edges and center. Start with a 40" x 38" piece of material.  
Final size is about 38" x 36".

Our canvas shop orders the material with NSN 8305-01-452-9332, and makes the cover using these measurements:

Fold and stitch one inch seams around entire outer edge.  
(Outer dimensions are **before** folds and stitching are done.)



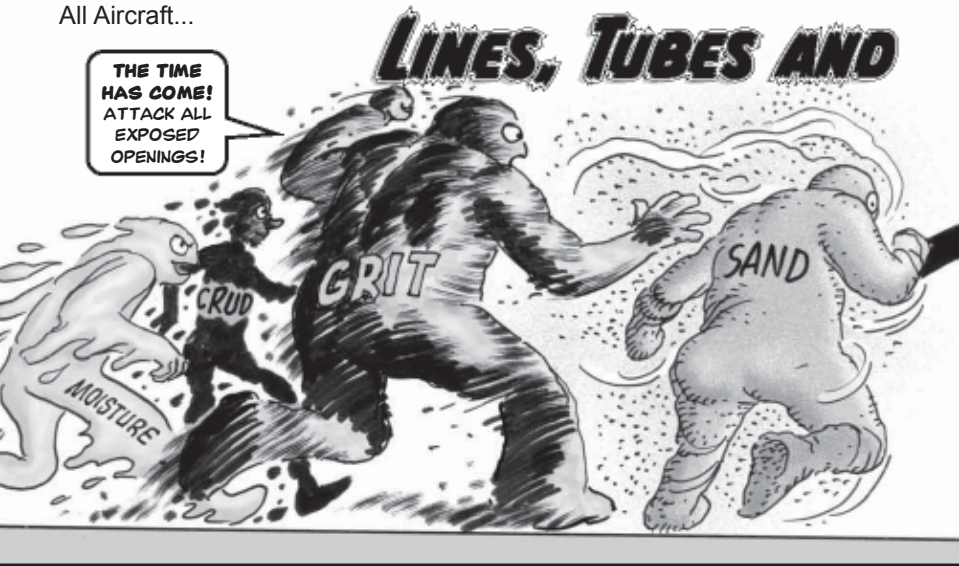
When finished, the cover looks like this:



SSG David King  
ALARNG  
Birmingham, AL

From the Desk of the Editor:

*You've got that problem covered.  
Good job!*



LEAVING AIRCRAFT LINES, TUBES AND FITTINGS UNCOVERED WITHOUT CAPS, BAGS OR PLUGS WHILE DOING CHECKS OR MAINTENANCE IS A BAD CHECK AGAINST YOU.

THIS IS WHAT YOU'LL GET...

✓ Dirt in open lines contaminates fluids and residue won't let connectors seal.

✓ Moisture in lube becomes paste and can't do its job.

✓ Threads get smashed, and delicate connector pins get broken or bent.

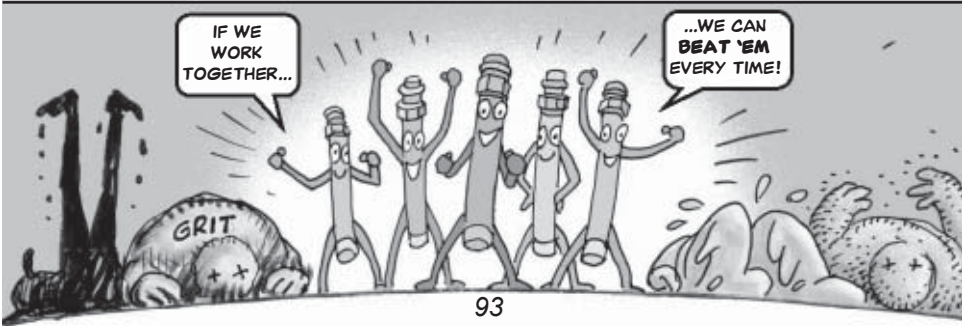
SO USE AND REUSE CAPS AND PLUGS THAT COME WITH COMPONENTS, HOSES, LINES AND FITTINGS. CHECK AND CAP, BAG OR WRAP ALL EXPOSED OPENINGS AND LINES TO PREVENT FLUID SPILLS, MOISTURE IN OIL AND DIRT BUILDUP.

Cap, bag, and plug all lines, tubes and fittings



IF YOUR TM DOESN'T LIST CAPS OR PLUGS TO USE, USE THIS LIST TO IDENTIFY PLUGS AND CAPS NEEDED TO SEAL FLUID SYSTEMS AND PROTECT THREADS ON YOUR BIRD...

Tube Plug (Flared) NSN 4730-	Size (Outside Diameter) inches
00-287-0109	1/8
00-287-0100 (plain)	3/16
00-287-0110	1/4
00-287-0111	5/16
00-715-0082	3/8
00-287-0112	3/8
00-287-0113	1/2
00-287-0116	5/8
00-287-0117	3/4
00-287-0118	1



HERE'S MORE  
INFO FOR YOU  
ON CAPS AND  
PLUGS!



Tube Cap (HYD) (Flareless) NSN 4730-	Size (Outside Diameter) inches
00-837-9842	1/8
00-115-0210	3/16
00-958-3704	1/4
00-640-0632	1/4
00-985-5165	5/16
00-618-3572	3/8
00-990-2585	3/8
00-451-2762	1/2
00-618-4227	5/8
00-412-8260	5/8
00-202-8792	3/4
00-221-2128	3/4
00-400-2223	3/4
00-085-1936	1
00-274-7120	1

Tube Plug (HYD) (Flareless) NSN 4730-	Size (Outside Diameter) inches
00-540-2231	1/8
00-595-3917	3/16
00-541-7198	1/4
00-541-1465	5/16
00-202-9169	5/16
00-203-3709	3/8
00-555-7804	3/8
00-202-8341	1/2
00-202-8860	1/2
00-966-5695	5/8
00-203-0247	5/8
00-289-8627	3/4
00-203-0246	3/4
00-203-6938	1
00-289-8626	1

Cap Tube (Flared) NSN 4730-	Size (Outside Diameter) inches
00-497-4244	1/8
00-221-2126	3/16
00-278-5006	1/4
00-061-4150	5/16
00-585-8769	3/8
00-221-2127	5/8
00-221-2128	3/4
00-221-2129	1

ADDITIONAL CAP AND PLUG  
INFO CAN BE FOUND IN YOUR  
GENERAL AIRCRAFT TMS.

CHECK OUT PARAS 4-5 AND  
4-5L OF TM 1-1500-204-23-  
2, AND YOUR CONSUMABLES  
LIST IN TM 1-1500-204-23-6  
FOR MORE INFO.

COURSE, ALWAYS USE CAPS  
AND PLUGS CALLED FOR IN  
YOUR MAINTENANCE TMS.

All Aircraft...

## Battling Creeps and Globs

COME ON,  
SLIMEBALL!  
MAKE MY DAY!



Creeps and globs may sound like something out of a horror movie, but what they can do to your aircraft is strictly for real. Some silicone and greases "creep." Grease applied during morning maintenance may be softened by midday heat. The softened grease—goo—creeps to other surfaces.

This greasy mess makes the surface a target for sand buildup. And by now, you know the destructive force of sand. Some mechanics "glob." They apply grease with a heavy hand, thinking that if a little works well, a lot will work even better. But that glob becomes a sand magnet and is a prime candidate for creep.

To battle the creeps and globs, you:

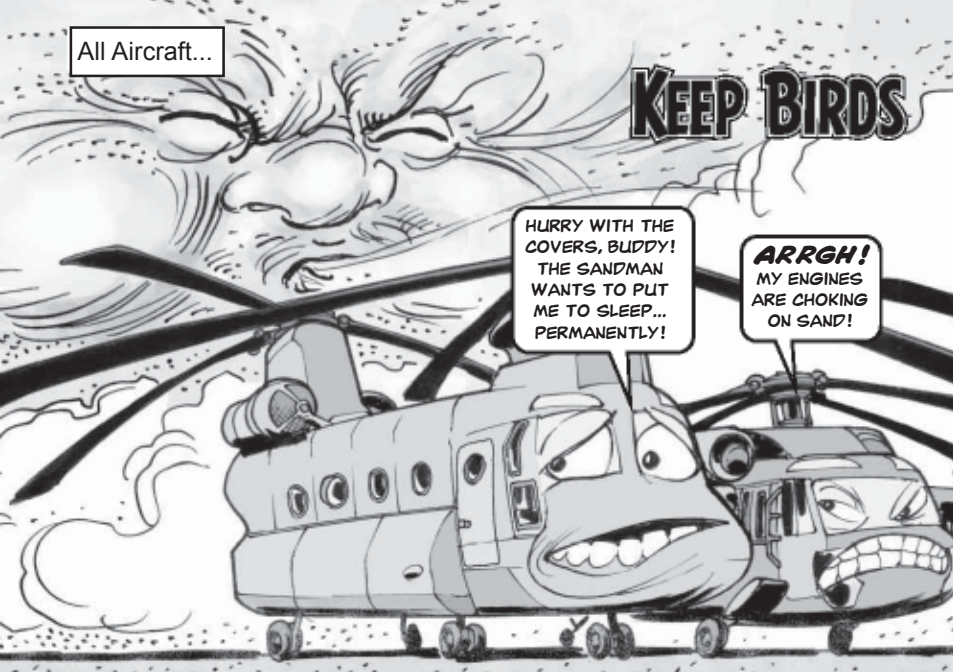
**APPLY** just the right amount of lube or sealant. Wipe away any excess.

**CHECK** all lube points in the heat of the day. Wipe away any creeps.

**REMEMBER** where creeps usually start. Check these areas often.

**USE** only sealants and lubes called for by the TM. Substitutes may seem to do the same job, but they may creep more easily.

All Aircraft...



AIRCRAFT MAINTENANCE IN THE DESERT STARTS WITH KEEPING YOUR BIRD **CLEAN AND UNDER COVER.**

THAT WAY, BLOWING SAND **CAN'T DESTROY** OPTICS, AIRCRAFT WINDSHIELDS, AVIONICS, AND ENGINES.

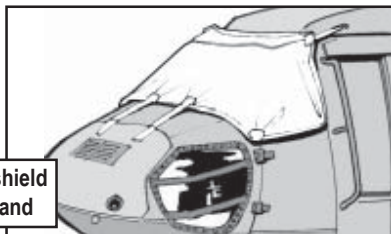
CHECK OUT THE COVER INFORMATION IN THESE TMS TO KEEP SAND AT BAY...

TM 1-1500-204-23-1  
TM 1-1520-237-23P-5  
TM 1-1520-238-23-1 and -8  
TM 55-1520-240-23-1  
TM 55-1520-23-10

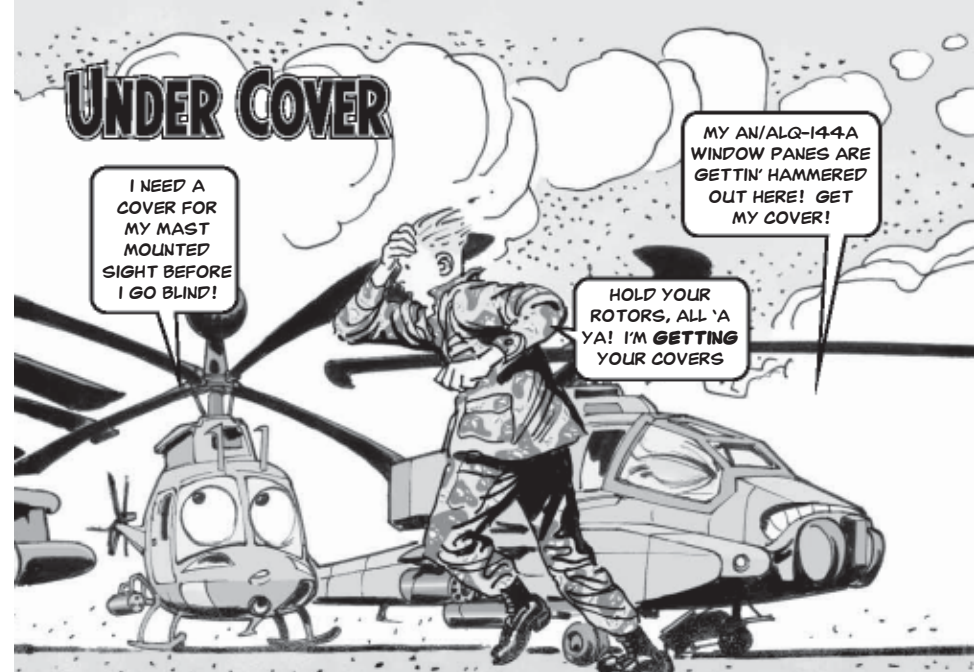
## Windshields

Before you cover the windshields, clean them **and** the cover. Even fine dust can scratch the windshield when the wind blows. When you attach the cover, make sure it's snug. Otherwise, wind will blow sand under the edges.

Cover windshield in blowing sand



## UNDER COVER



## Optics and Commo

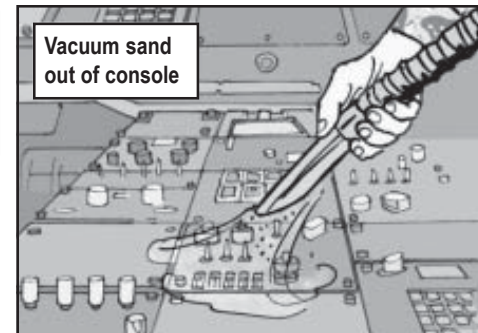


SAND'S WORST DESTRUCTION IS UNLEASHED ON YOUR OPTICS AND COMMUNICATIONS EQUIPMENT.

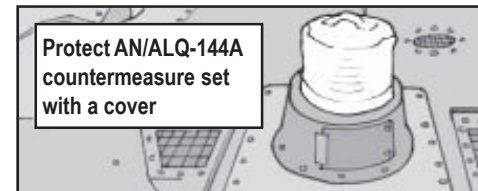
When not in use, keep optic lenses covered with cling film, NSN 5330-00-766-0062. Use a vacuum, NSN 7910-00-807-3704, to suck up dirt and sand from instrument panels, switches, flight controls and cable connectors.

When not in use, keep all avionics equipment covered. Just a little sand will grind up delicate commo.

Vacuum sand out of console



Protect AN/ALQ-144A countermeasure set with a cover

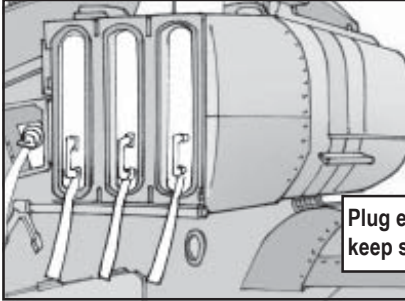


## Engines

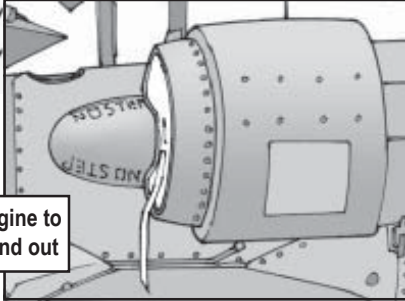
Your engine can also fall victim to the destructive power of sand.

Sand gets trapped in excess grease and form a paste that wears out lubricated parts. Keep the engine inlet cover on and tight. If it blows off, or doesn't seal the inlet, the engine will fill with sand. Then you can kiss your engine goodbye.

YOUR ENGINE CAN ALSO FALL VICTIM TO THE DESTRUCTIVE POWER OF SAND.

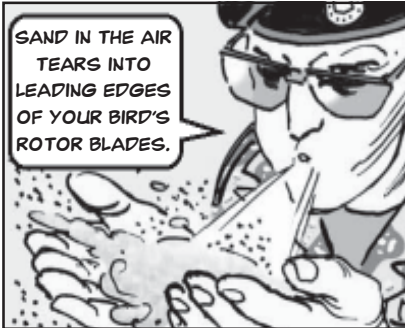


Plug engine to keep sand out

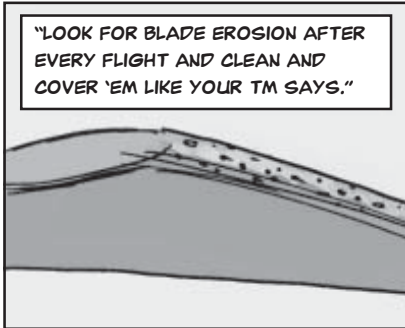


## Rotor Blades

SAND IN THE AIR TEARS INTO LEADING EDGES OF YOUR BIRD'S ROTOR BLADES.



"LOOK FOR BLADE EROSION AFTER EVERY FLIGHT AND CLEAN AND COVER 'EM LIKE YOUR TM SAYS."



## Other Areas

Tape all openings or seams around windows, chin bubbles, and access panels. Be thorough, but be sure you don't stop airflow that is needed to cool parts.

Of course, always check out TM 1-1500-204-23-1 and FM 1-202, *Environmental Flight*, for other hot weather and desert environment tips.

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Headquarters  
DEPARTMENT OF THE ARMY  
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By Order of the Secretary of the Army:

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Comments and suggestions on how to improve this Technical Bulletin should be sent to Commander, USAMC LOGSA, AMXLS-AM, Bldg 5307, Redstone Arsenal, AL 35898-5000.



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